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**King et al.**

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(54) **RESTRICTED EXECUTION MODES**

(71) Applicant: **Microsoft Technology Licensing, LLC**,  
Redmond, WA (US)

(72) Inventors: **Joseph Spencer King**, Seattle, WA (US); **Michael Burt Goulding**, Redmond, WA (US); **Todd Myles Derksen**, Redmond, WA (US); **Aaron Naoyoshi Sheung Yan Woo**, Bellevue, WA (US); **Bernardo Iturriaga Dubost**, Kirkland, WA (US); **Alan Bennett Auerbach**, Sammamish, WA (US); **David A. Braun**, Redmond, WA (US); **Andrew P. Begun**, Redmond, WA (US); **Andrew Craig Haon**, Seattle, WA (US); **Joseph H. Matthews, III**, Woodinville, WA (US); **Jennifer Anne Karr**, Edmonds, WA (US); **Joseph A. Schrader**, Kirkland, WA (US); **Ted Tai-Yu Chen**, Seattle, WA (US); **Raman K. Sarin**, Redmond, WA (US); **Sharad Agarwal**, Seattle, WA (US); **Shai Guday**, Redmond, WA (US); **Shawn M. Thomas**, Redmond, WA (US); **John D. Skovron**, Bellevue, WA (US); **John A. Yovin**, Woodinville, WA (US)

(73) Assignee: **MICROSOFT TECHNOLOGY LICENSING, LLC**, Redmond, WA (US)

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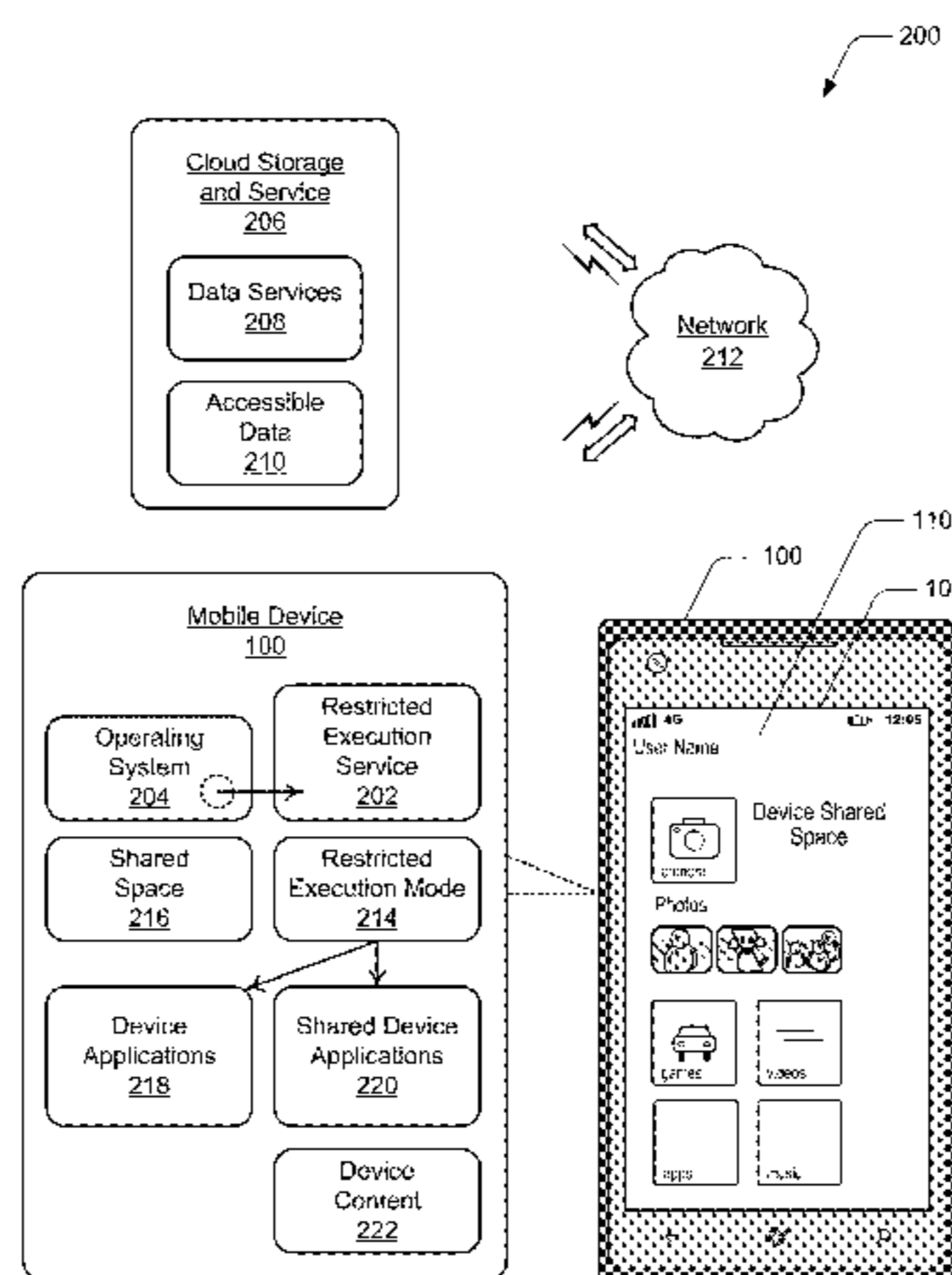
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*Primary Examiner* — Saleh Najjar  
*Assistant Examiner* — Simon Kanaan



(57) **ABSTRACT**

In embodiments of restricted execution modes, a mobile device can display a device lock screen on an integrated display device, and transition from the device lock screen to display a shared space user interface of a shared space. The transition to display the shared space user interface is without receiving a PIN code entered on the device lock screen. The mobile device implements a restricted execution service that is implemented to activate a restricted execution mode of the mobile device, and restrict access of a device application to device content while the restricted execution mode is activated. The restricted execution service can also allow a shared device application that is included in the shared space access to the device content while the restricted execution mode is activated.

**20 Claims, 10 Drawing Sheets**

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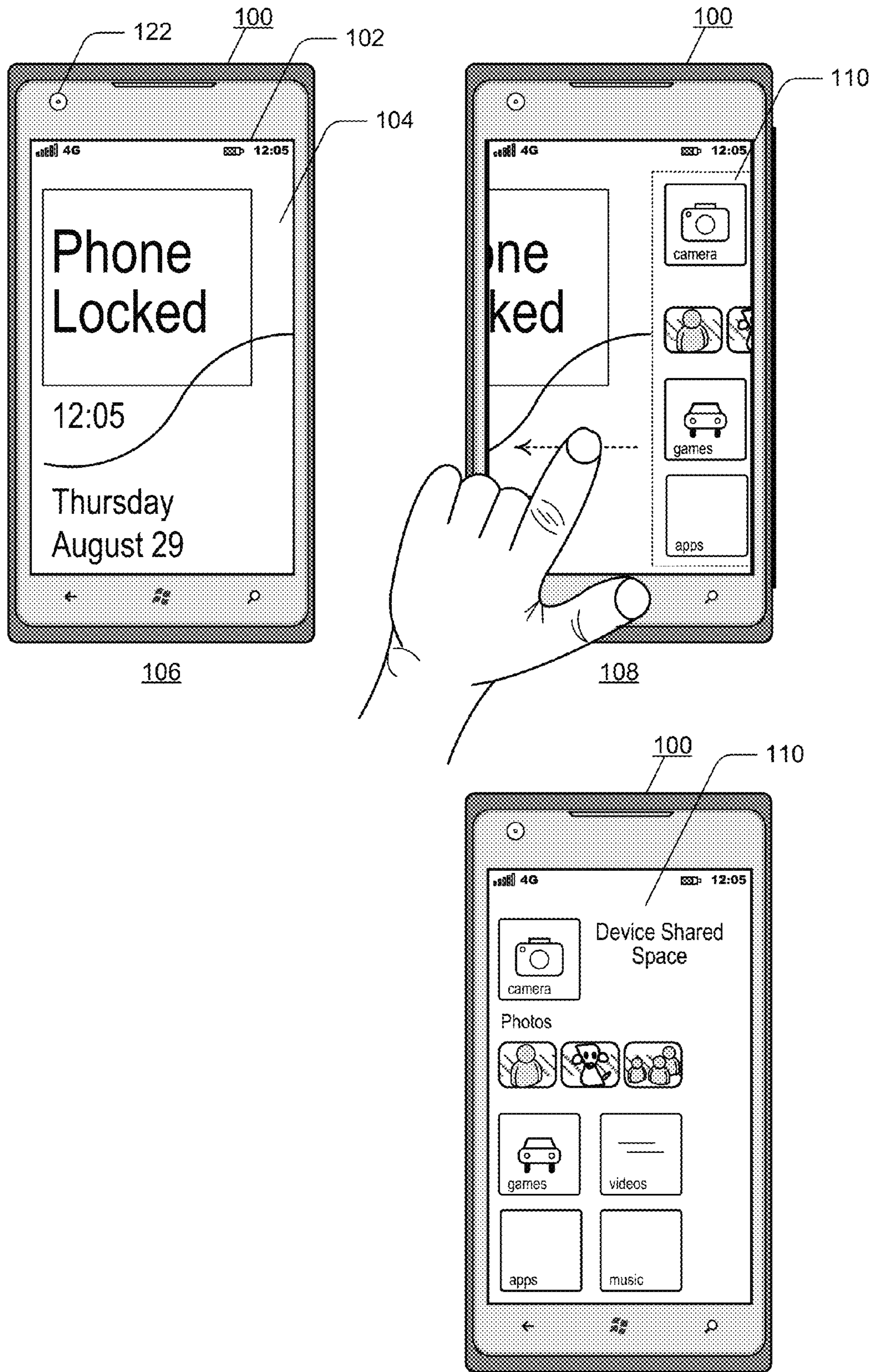


FIG. 1

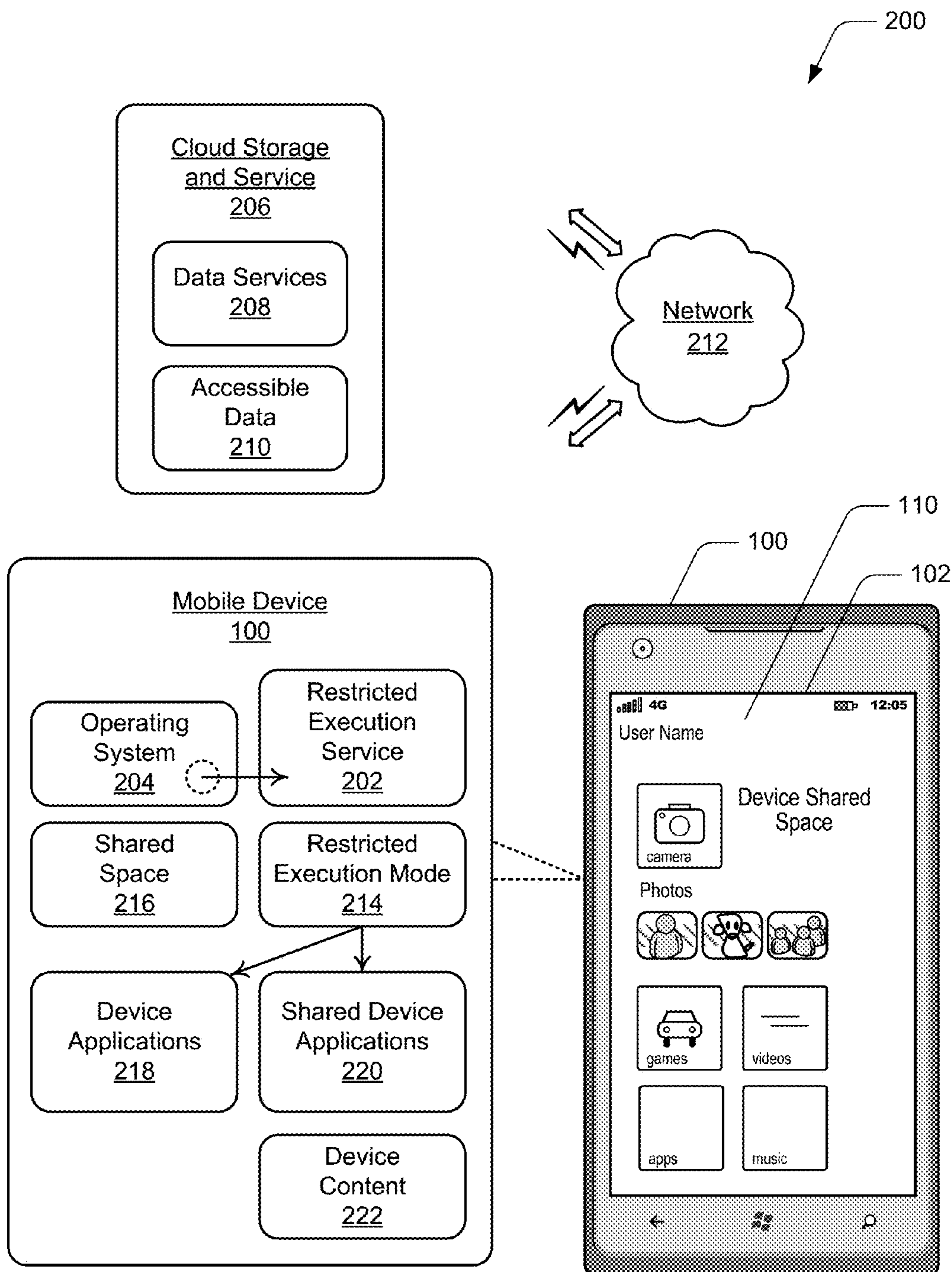
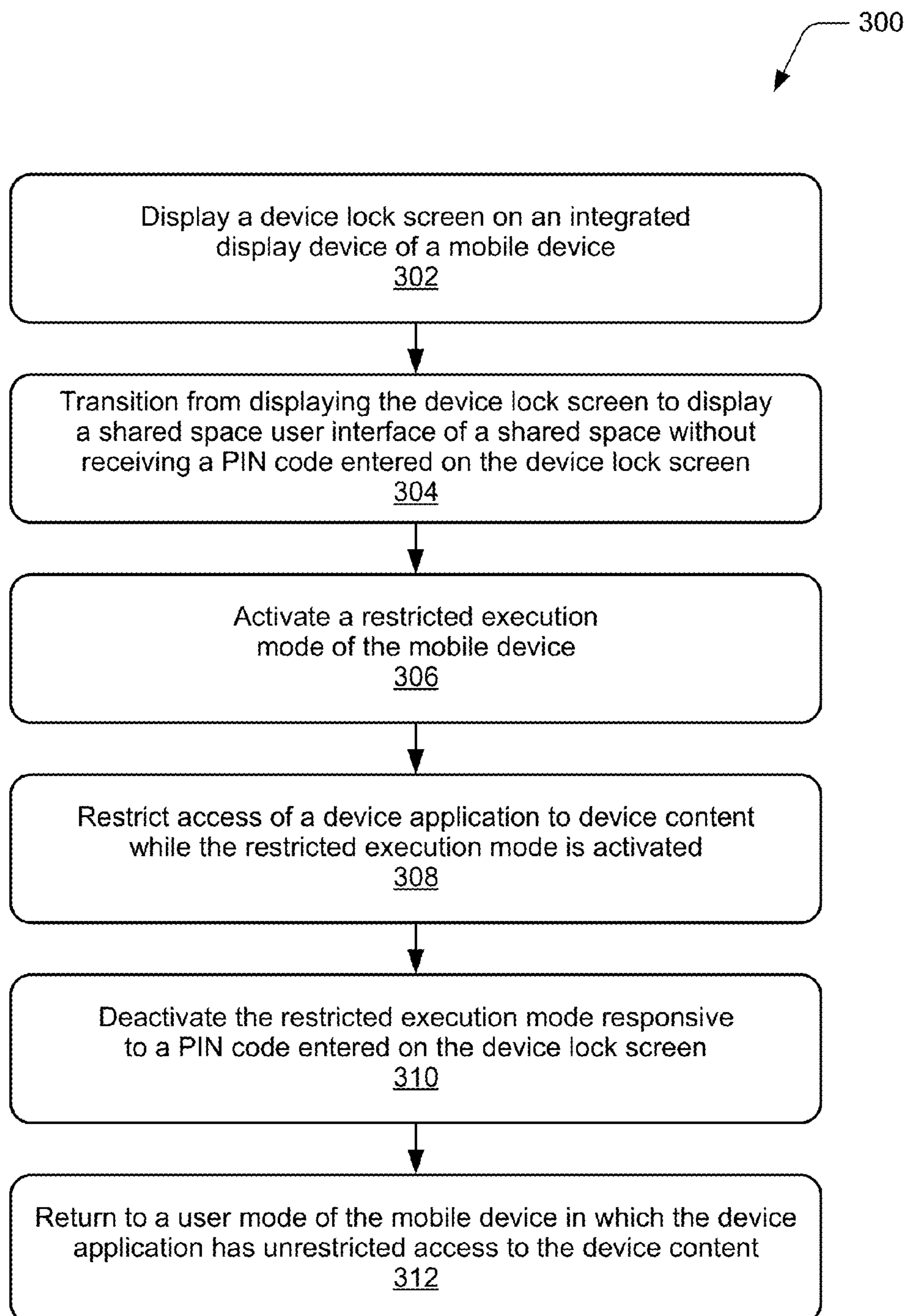
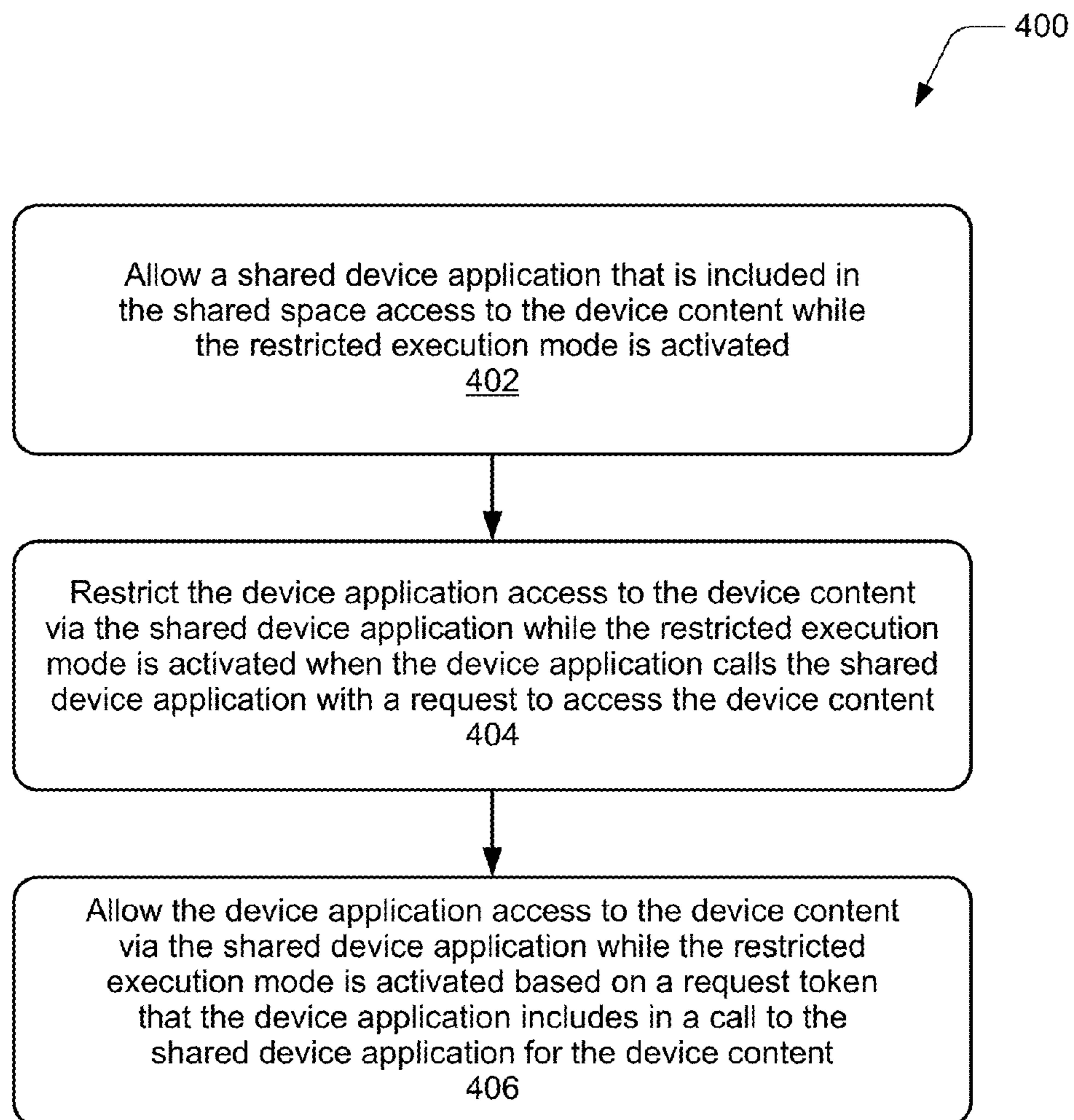
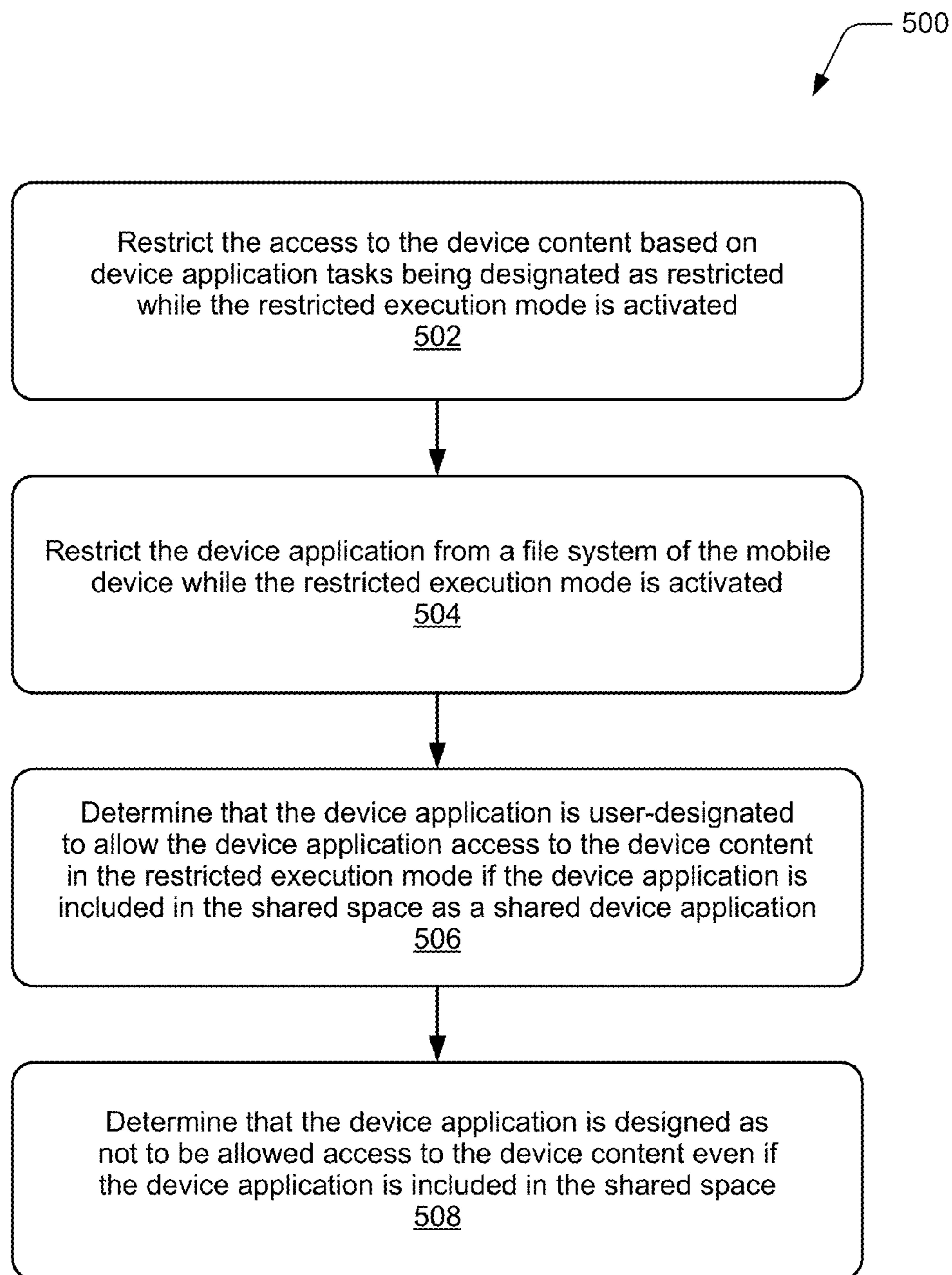


FIG. 2

*FIG. 3*

**FIG. 4**

**FIG. 5**

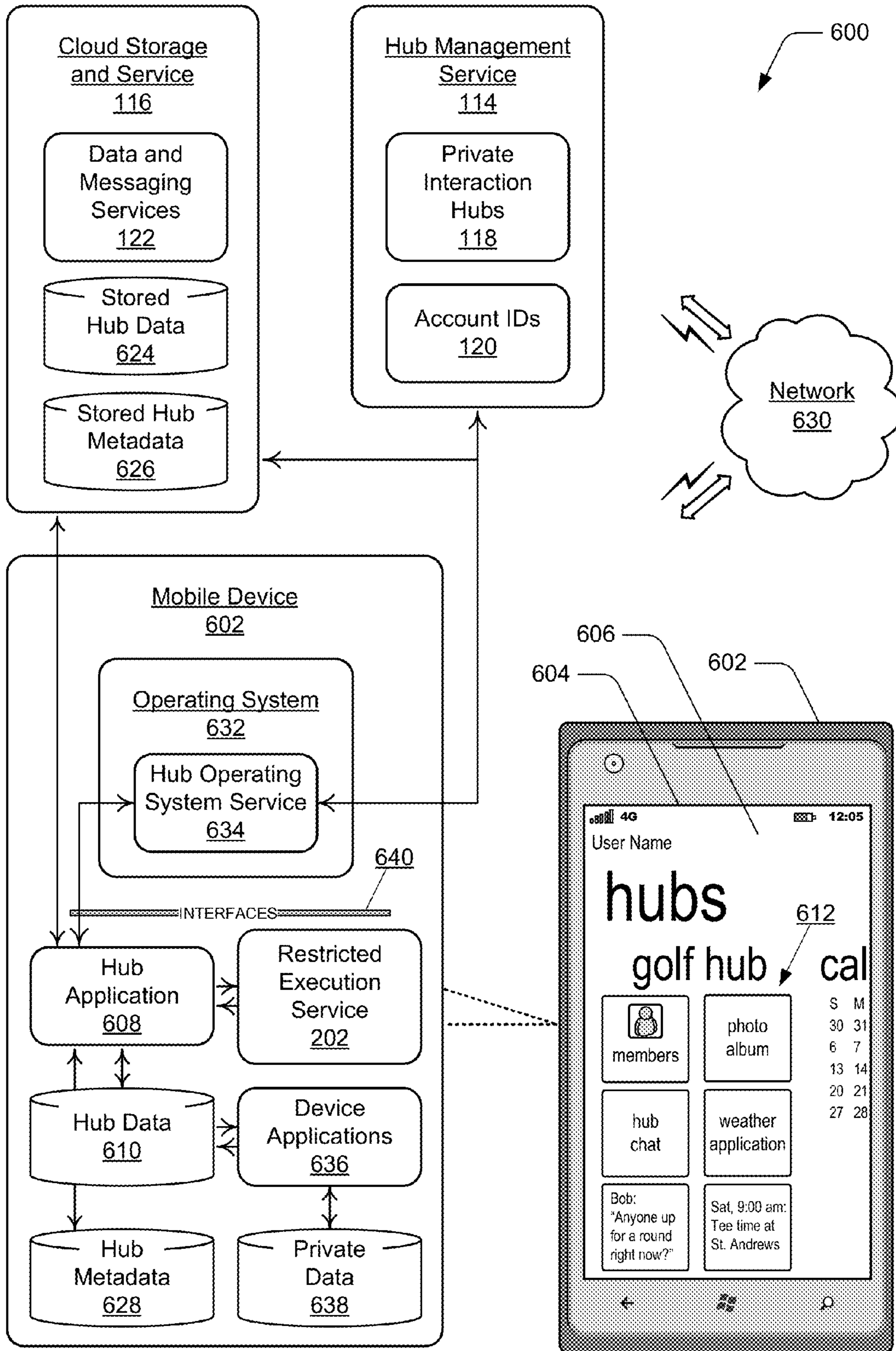


FIG. 6

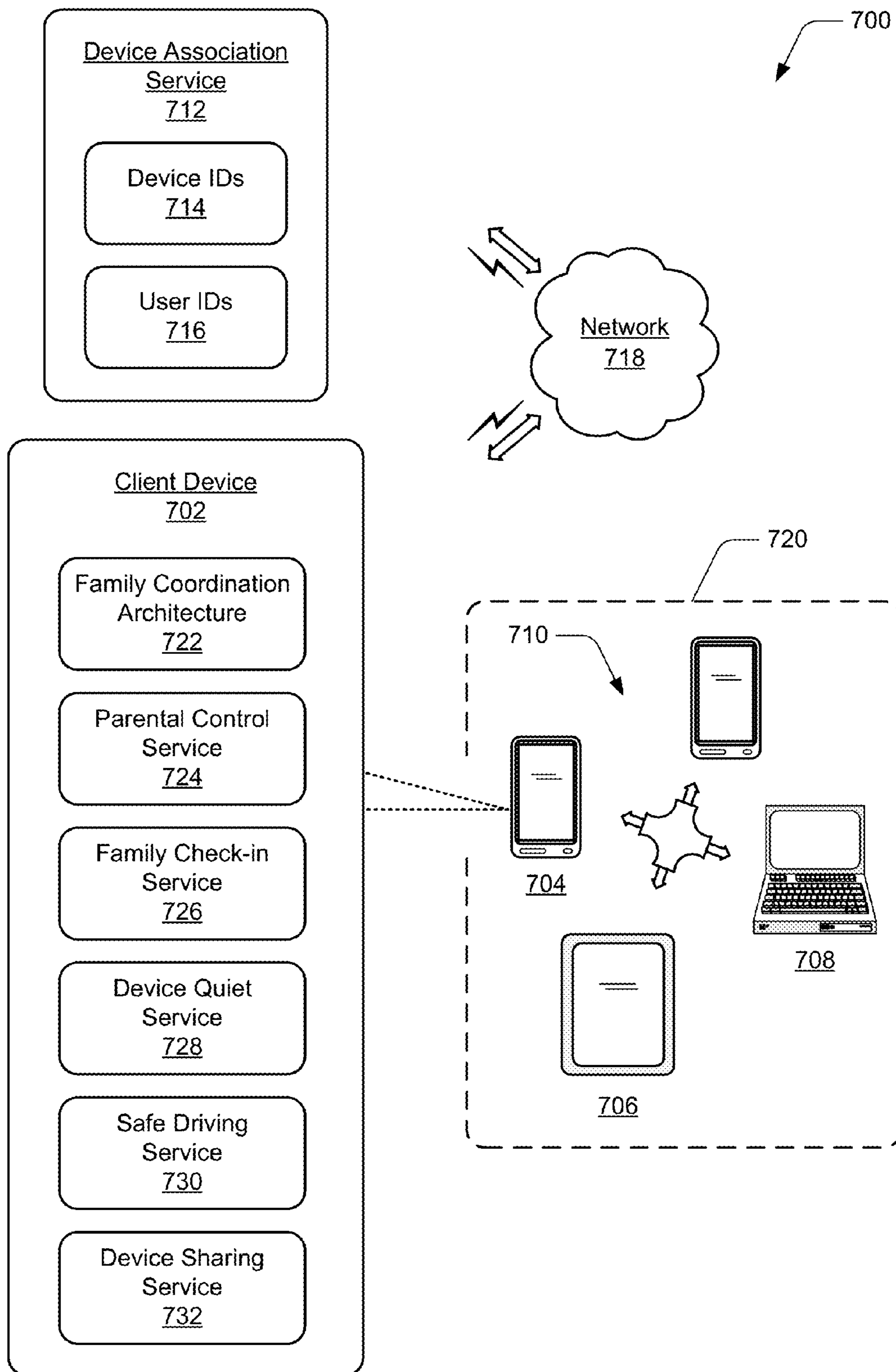


FIG. 7



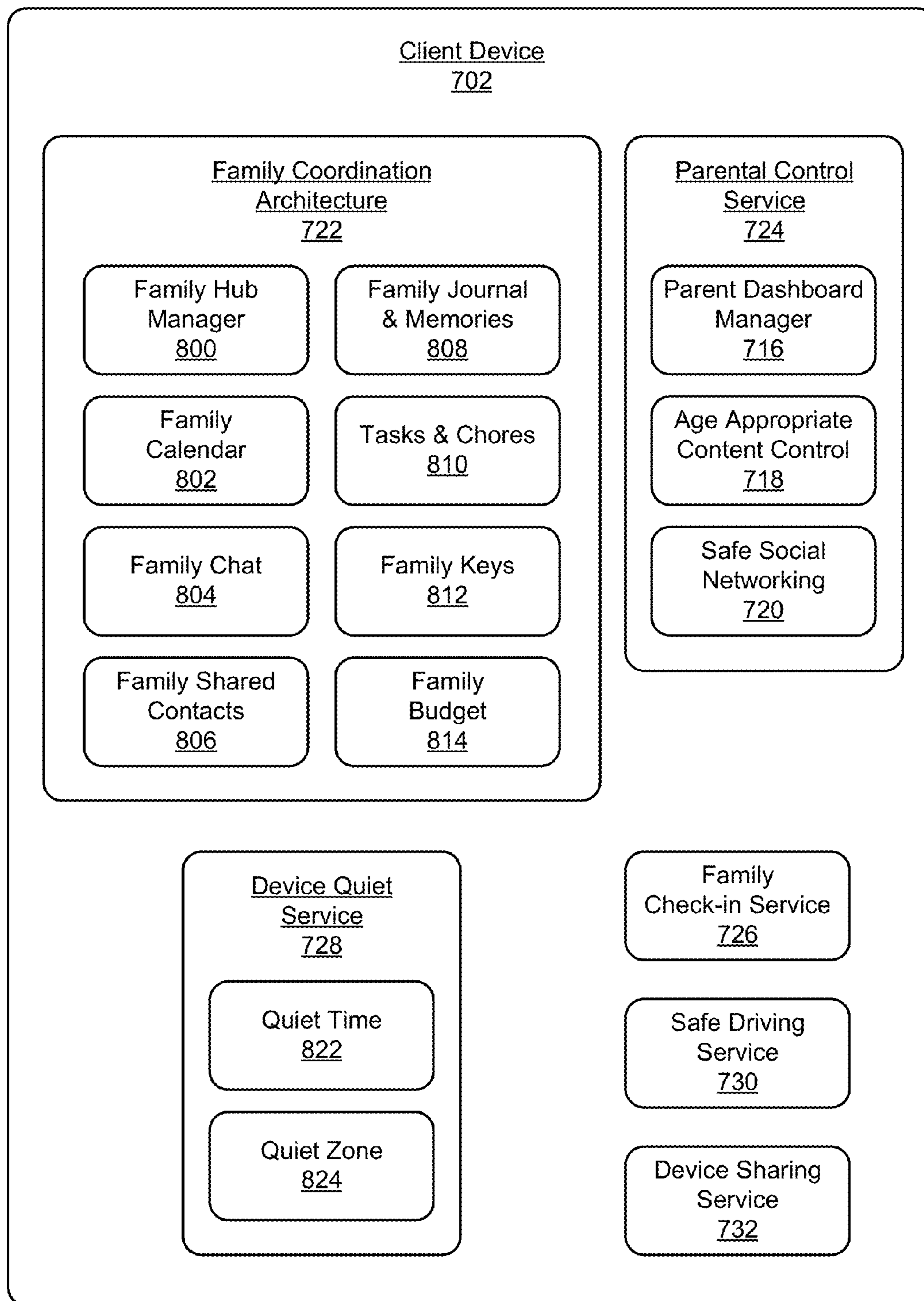


FIG. 8

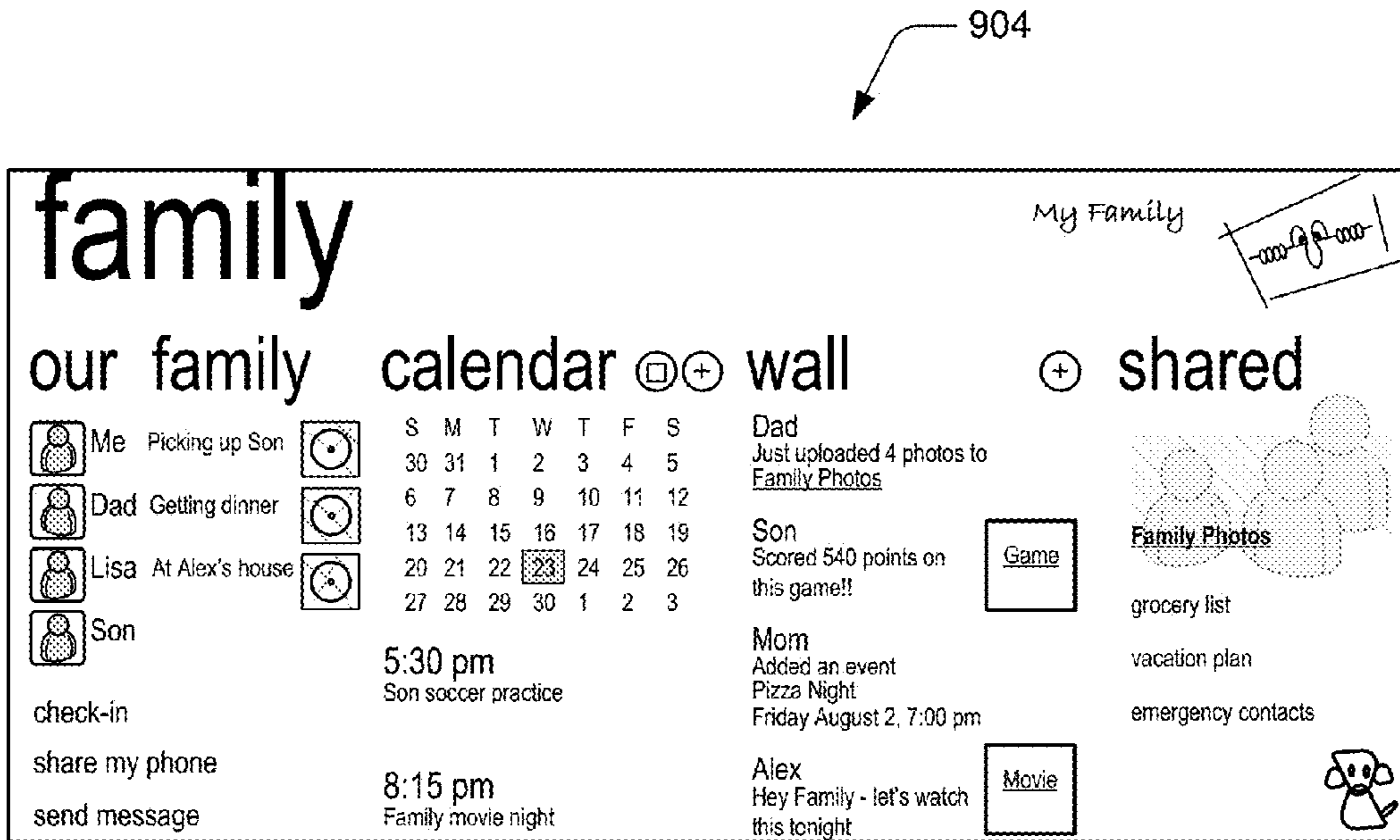
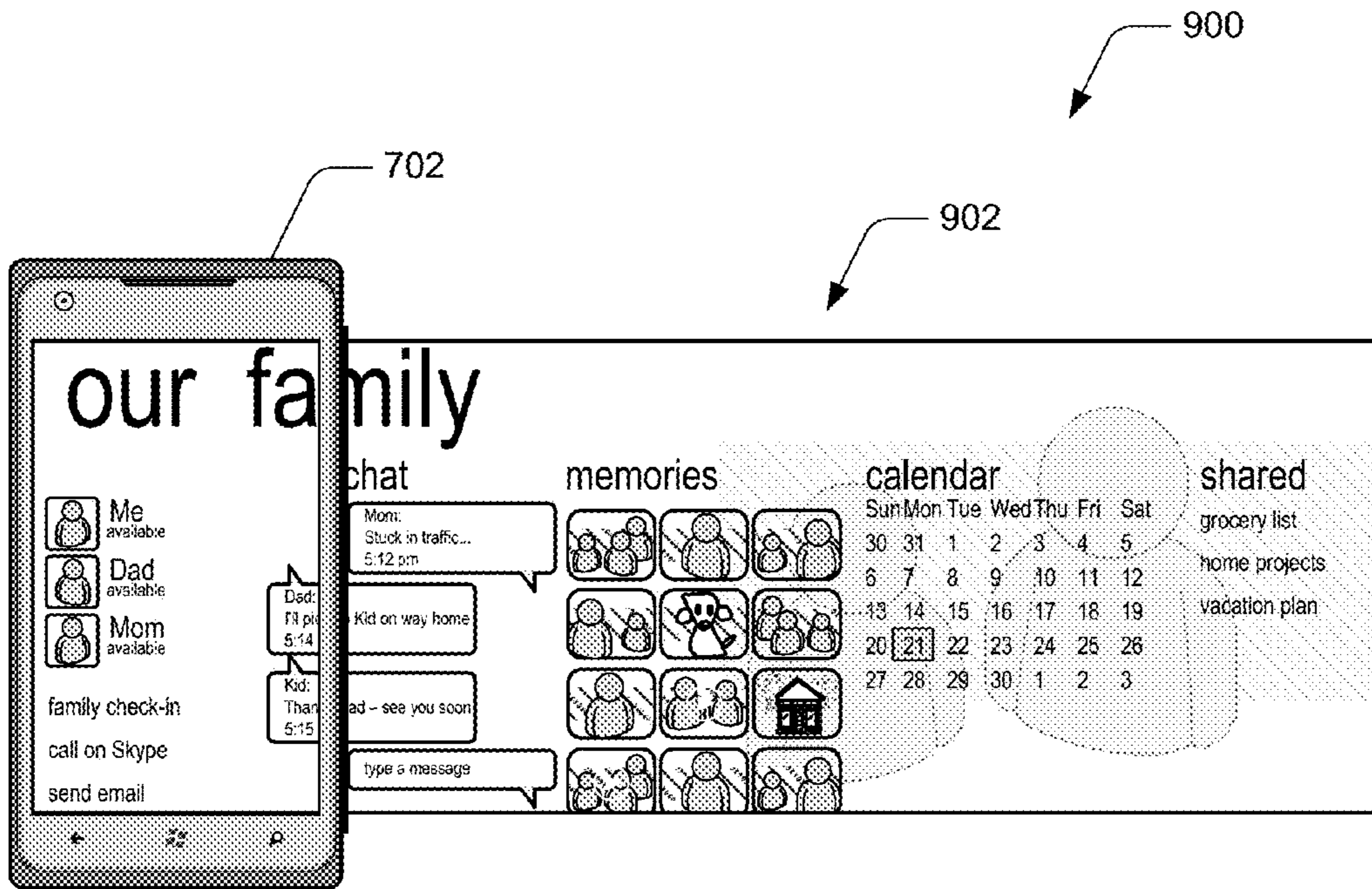


FIG. 9

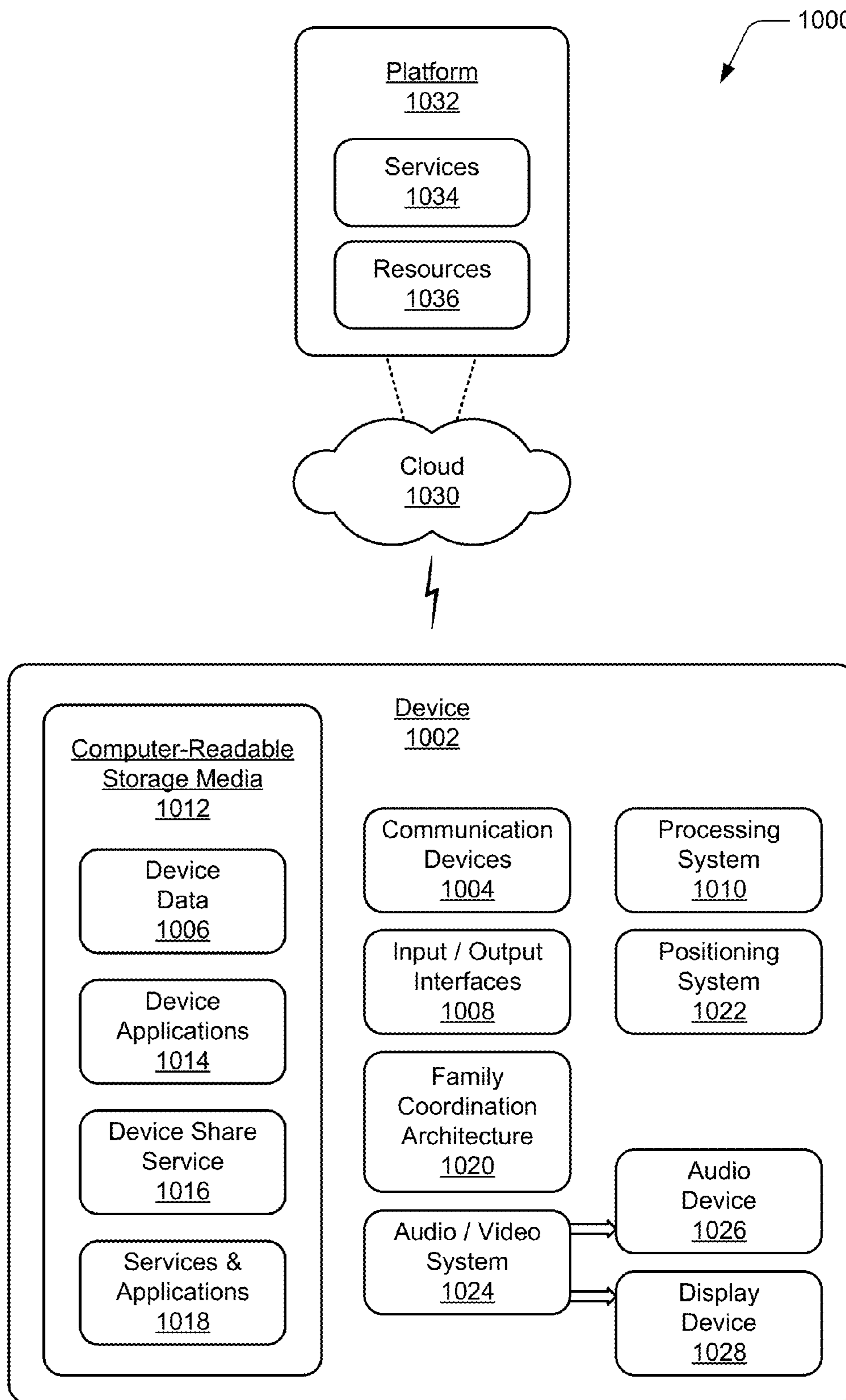


FIG. 10

**RESTRICTED EXECUTION MODES**

## RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 13/726,099 filed Dec. 22, 2012 entitled “Restricted Execution Modes,” which claims priority under 35 U.S.C. Section 119(e) to U.S. Provisional Application Ser. No. 61/580,147 filed Dec. 23, 2011 entitled “Mobile Device Shared”, the disclosures of which are incorporated by reference herein in its entirety. This application also claims priority under 35 U.S.C. Section 119(e) to U.S. Provisional Application Ser. No. 61/695,294 filed Aug. 30, 2012 entitled “Mobile Device Kid Space”, the disclosure of which is incorporated by reference herein in its entirety.

## BACKGROUND

Many types of devices, such as mobile phones, tablet devices, and other computing, communication, and entertainment devices increasingly offer more functions, applications, and features which are beneficial to a user, and can enhance one’s personal time as well as work and social activities. For example, not only can a mobile phone be used for text, email, and voice communications, but may also be used for entertainment, such as to listen to music, surf the Internet, watch video content, gaming, and for photo and video imaging. Similarly, a portable tablet device may be utilized for email, browser, navigation, and other computing applications, as well as for the various entertainment and photo features. In addition to the many computing, communication, and entertainment applications that are available to a user of a mobile phone or tablet device, a seemingly unlimited number of third-party applications and features are also available for download to a device.

Parents of younger children that do not yet have their own mobile phones often find that a child wants to “play” with their phone to play games, take pictures, listen to music, and other activities. Typically, a parent may pass his or her phone to a young child in the back seat of the car while driving to keep the child entertained. The parent may not know then what features and applications the child access on the device, such as a Web browser or unintentionally accessing an email application, or which device settings may have been changed, such as audio settings, alarm settings, calendar notices, and the like.

## SUMMARY

This Summary introduces features and simplified concepts of restricted execution modes, which are further described below in the Detailed Description and/or shown in the Figures. This Summary should not be considered to describe essential features of the claimed subject matter, nor used to determine or limit the scope of the claimed subject matter.

Restricted execution modes is described. In embodiments, a mobile device can display a device lock screen on an integrated display device, and transition from the device lock screen to display a shared space user interface of a shared space. The transition to display the shared space user interface happens without receiving a PIN code or other authentication credential entered on the device lock screen. The mobile device implements a restricted execution service that is implemented to activate a restricted execution mode of the mobile device, and restrict access of a device application to device content while the restricted execution mode

is activated. The restricted execution service can also allow a shared device application that is included in the shared space access to the device content while the restricted execution mode is activated.

In embodiments, the restricted execution service restricts device application access to the device content via the shared device application while the restricted execution mode is activated when the device application calls the shared device application with a request for the device content. Alternatively, the restricted execution service can allow the device application access to the device content via the shared device application while the restricted execution mode is activated based on a request token that the device application includes in a task call to the shared device application for the device content. The request token indicates that the device application is permitted to access the device content via the shared device application in the shared space.

In embodiments, a device application may be implemented or designed so that a user can designate to allow the device application access to the device content if the device application is included in the shared space as a shared device application. Alternatively, a device application may be designed as not to be allowed access to the device content even if the device application is included in the shared space. Additionally, this type of a device application may also be implemented as not even being eligible for user-designation to be included in the shared space. A device application that is included in the shared space can initiate a task call to access the device content. However, the restricted execution service restricts access to the device content based on one or more of the device application tasks being designated as restricted while the restricted execution mode is activated. The restricted execution service can also restrict the device application from a file system of the mobile device while the restricted execution mode is activated.

## BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of restricted execution modes are described with reference to the following Figures. The same numbers may be used throughout to reference like features and components that are shown in the Figures:

FIG. 1 illustrates an example of restricted execution modes.

FIG. 2 illustrates an example system in which embodiments of restricted execution modes can be implemented.

FIG. 3 illustrates example method(s) of restricted execution modes in accordance with one or more embodiments.

FIG. 4 illustrates example method(s) of restricted execution modes in accordance with one or more embodiments.

FIG. 5 illustrates example method(s) of restricted execution modes in accordance with one or more embodiments.

FIG. 6 illustrates an example system in which embodiments of private interaction hubs can be implemented.

FIG. 7 illustrates an example system in which embodiments of restricted execution modes and/or family coordination can be implemented.

FIG. 8 illustrates various client device services and features in accordance with one or more embodiments.

FIG. 9 illustrates examples of a family hub in accordance with one or more embodiments.

FIG. 10 illustrates an example system with an example device that can implement embodiments of restricted execution modes.

## DETAILED DESCRIPTION

Embodiments of restricted execution modes are described and provide a restricted execution service that can be

implemented as a client device service or application, such as in a mobile phone, portable tablet device, or other type of computing and/or communication device. Restricted execution modes enable implementation of a shared space on a device where a user owner can include device applications that a guest or child can access without requiring a password, and the device applications will be programmatically prevented from being able to access other private device content on the device.

There may be situations when a user owner of a device may want to have access to some content or applications on their mobile phone without unlocking the phone with a PIN code or other authentication credential. Restricted execution modes enable the user owner to make some experiences available without password access, and without compromising the security of sensitive personal or corporate data. In implementations, restricted execution modes allow applications to run, but restricts access to sensitive data or experiences using several mechanisms, such as security capabilities, blocked navigation, and application origin. If an application has a particular security capability, a runtime check is made centrally when the application attempts to access a protected resource, and if the application is running in a restricted execution zone, an error is returned that can be handled by the application. When a device is running in a restricted execution mode, a device application may be referred to as running in a restricted execution “zone”.

For the blocked navigation security capability, applications often take advantage of built in tasks to complete user actions like sending an email, making a phone call, etc. When the restricted execution mode is activated on a device, the origination of a device application task at run-time is what is considered to determine whether the device application, and more specifically, whether the task will be allowed. An application task, which is generally synonymous to an application programming interface (or API) call, may include aspects of a data access API call, but it also includes a request to initiate a particular action or actions different than data access, and the task request may incorporate metadata associated with the action of the requested task. The level of functionality is provided on a task-by-task basis to determine whether the action or actions of a requested task will be available in the restricted execution mode during run-time origination of a task request. A device application can be executed by the device, but only some functions of the device application will execute when the restricted execution mode is activated on the device.

Examples of restricting the functionality of a device application may include not permitting the device application to be launched altogether or limiting the device application to calling only a restricted subset of API calls that is narrower than the normal set of API calls available to the application when the mobile device is running in normal user mode. Restricting access to device content also may include disallowing certain API calls that provide access to particular sets of data or content. In many examples, restricting functionality or access does not include analyzing or changing Access Control Lists (ACLs), Access Control Entries (ACEs), or similar file-system access control metadata maintained by a file system. For example, a device application can be restricted from access to device content while a restricted execution mode is activated on a device.

When running in a restricted execution zone, all application requested navigations are screened and only those allowed by the system can continue. Others fail in a backwards compatible way so that legacy applications do not need to be updated to run in the restricted execution zone.

For the application origin security capability, only applications that originate and/or have been downloaded from a first-party provider can run (e.g., execute) in a restricted execution mode. This ensures that applications which have not been security checked, and may access sensitive and/or private data on a device, do not run without the user unlocking the device first.

While features and concepts of restricted execution modes can be implemented in any number of different devices, systems, environments, and/or configurations, embodiments of restricted execution modes are described in the context of the following example devices, systems, and methods.

FIG. 1 illustrates an example of user interfaces of a restricted execution mode. An example mobile device **100** may be any one or combination of a mobile phone, tablet device, computing device, communication, entertainment, gaming, navigation, and/or other type of portable electronic device. A shared space can be implemented for user access to functionality of device applications without a password, as well as for access to any applications, functions, and features of the mobile device **100** that are designated by the user in the shared space.

The example mobile device **100** includes an integrated display device **102** on which user interfaces can be displayed, such as a device lock screen **104** that indicates the device is locked at **106**. For example, a user owner of the mobile device may set-up the device to lock when not in use so that someone else cannot access the full functionality of applications, such as email and text, and/or have access to the Internet via a browser application without providing authentication credentials such as a personal identification number (PIN), login, or other authentication credential.

The user owner of the mobile device **100** can allow another person to use the phone, and hand the phone over without having to unlock the device from the device lock screen **104** by entering a PIN or other credential. As shown in the example **108**, a person that has borrowed the phone can swipe the device lock screen with a gesture input to access a shared space user interface **110**, which is illustrated at **112** when displayed on the display device, and which provides access to a limited subset of application functionality. The borrower does not enter a PIN or other credential to access the shared space user interface. In implementations, the gesture input may be any type of user and/or gesture input in any direction on the integrated display device **102** of the mobile device. Alternatively or in addition, any type of device, button, and/or gesture inputs may be utilized effective to transition from the device lock screen **104** to the shared space user interface **110**.

FIG. 2 illustrates an example system **200** in which embodiments of restricted execution modes can be implemented. The example system includes the mobile device **100** as described with reference to FIG. 1, with the integrated display device **102** on which a user interface can be displayed, such as the shared space user interface **110** that is representative of a shared space on the device. Additionally, the mobile device can be implemented with various components, such as a processor and/or memory system, as well as any number and combination of differing components as further described with reference to the example device shown in FIG. 10 to implement embodiments of restricted execution modes.

The mobile device **100** includes a restricted execution service **202** that can be implemented as a software application (e.g., executable instructions) stored on computer-readable storage media, such as any suitable memory device or electronic data storage. Additionally, the restricted execution

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service **202** can be executed with a processing system at the mobile device to implement embodiments of restricted execution modes as described herein. The restricted execution service **202** may be implemented as an independent device application that is executable on the device to interface with the many applications, features, and functions of the device.

The example system **200** may also include a cloud storage and service **206** that can include any type of cloud-based (e.g., network-based) data services **208** used to store or maintain accessible data **210** (e.g., data accessible by device applications on the mobile device **100**). Any of the devices and services (e.g., implemented as server devices) described herein can communicate via a network **212**, which can be implemented to include a wired and/or a wireless network. The network can also be implemented using any type of network topology and/or communication protocol, and can be represented or otherwise implemented as a combination of two or more networks, to include IP-based networks and/or the Internet. The network may also include mobile operator networks that are managed by a mobile network operator and/or other network operators, such as a communication service provider, mobile phone provider, and/or Internet service provider. Alternatively or in addition, peer-to-peer communication techniques may be utilized, such as multiple devices connected using a peer-to-peer communication network.

The restricted execution service **202** is implemented to manage a restricted execution mode **214** of a shared space **216**, such as to limit and/or restrict device applications **218** and shared device applications **220** that are included in the shared space **216** that is accessible without a PIN or authentication credential. The device applications **218** can include any type of software applications, and the functions and features thereof, that run on the device, such as for user interaction with messaging, gaming, media playback, document viewing, and communication applications. The device applications may also include system-level components that users of a device generally do not access or utilize, but that typically run in the background while the device is operational. The shared device applications can include any subset of the device applications, and are designated as a shared device application when included in the shared space **216** for limited and/or restricted functionality when a restricted execution mode **214** is activated on the device.

A user owner of the mobile device **100** can choose the device applications and features, and/or device content, that can be included in the shared space and accessed by a child or guest while the restricted execution mode is activated. Further, a device application may be allowed a restricted level of functionality while running in the shared space (i.e., the application may be executed), yet generally cannot access device content **222** that is restricted from access, such as contacts, email, and calendar databases, as well as limited access to the device file system.

The content databases, device file system, Internet access, and other device content and features can be protected from device application access when the restricted execution mode is activated. For example, a device application that can access the Internet, email, contacts, etc. when a device is unlocked and operating in a normal user mode will be automatically restricted when the restricted execution mode is activated, such as if the device application has been added to the shared space and is allowed limited functionality in the shared space. As an example, a digital camera application that has been added to the shared space may allow a user

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to take and view new photos, but previous photos will be restricted from viewing the restricted execution mode is activated on the device.

The shared space user interface **110** of the shared space is customizable by the user owner of the device. For example, the user owner can add applications, such as games and music applications, to the shared space so that the applications are recognized and can be launched in the shared space, perhaps with limited functionality. However applications that are not recognized in the shared space cannot be launched in the shared space. For example, if a game application that is pinned or recognized in the shared space attempts to itself launch a browser application (e.g., as part of the game's execution), the restricted execution service **202** will check if the browser application is pinned and recognized in the shared space. If the browser application is not recognized in the shared space, then the restricted execution service will fail to launch the application, or if the browser application is recognized, then the browser application can be launched in the shared space by the game application.

As described with reference to FIG. 1, an input can be received, such as a gesture input or device selectable control input, and the restricted execution service **202** initiates a transition from displaying the device lock screen **104** to display the shared space user interface **110** of the shared space **216** without receiving a PIN code or other authentication credential entered on the device lock screen. The restricted execution service **202** is implemented to manage the shared space **216** when the restricted execution mode **214** is activated. The restricted execution service **202** can activate the restricted execution mode **214** of the mobile device **100**, and restrict access of a device application **218** to the device content **222**, to a file system of the mobile device, and/or to limit the application to a limited set of functionality or tasks while the restricted execution mode is activated.

The shared space **216** can include a shared device application **220**, and the restricted execution service **202** can allow the shared device application access to the device content **222** while the restricted execution mode **214** is activated. The restricted execution service **202** can determine whether a device application **218** is implemented or designed so that a user can designate to allow the device application access to the device content if the device application is included in the shared space **216** as a shared device application. Alternatively, a device application may be designed as not to be allowed access to the device content even if the device application is included in the shared space. Additionally, this type of a device application may also be implemented as not even being eligible for user-designation to be included in the shared space.

In restricted modes, a configuration of a device application may be designed or programmed to indicate whether the device application is ever to be allowed to run (e.g., execute) in a restricted mode, irrespective of user choice. For example, a confidential corporate application or another application downloaded from a third-party application store that may access private corporate data can be configured to never be allowed to run (e.g., execute) in any restricted mode, even if a user would like it to do so. A configuration of some device applications may be user-controlled to indicate whether the device application is to be allowed to run in a particular restricted mode, such as allowing a subset of games or applications in a kid zone restricted mode, or allowing a subset of camera lens applications to run when the phone is locked.

The restricted execution service **202** can also be implemented to validate whether or not a given device application can be navigated to regardless of the reason for the navigation request, taking into account the current restricted mode and the target application's system and user configuration. Additionally, a separate navigation stack can be maintained for a normal mode user experience and for the current restricted execution mode. The restricted execution service **202** is also implemented to allow or disallow migration of applications from the normal mode stack to the restricted mode stack or vice-versa based on scenario needs, and to determine when to close applications on each stack based on available resources and transitions into and out of a restricted mode.

A device application **218** may initiate a task call to a shared device application **220** with a request for the device content **222**, and the restricted execution service **202** can restrict the device application access to the device content via the shared device application while the restricted execution mode **214** is activated. The device application may also initiate a task call to the operating system **204** to request device content access, and the restricted execution service can restrict the access to the device content based on one or more device application tasks being designated as restricted while the restricted execution mode is activated.

Alternatively, the device application **218** can initiate a task call to the shared device application **220** with a request for the device content **222**, and the request includes a request token that indicates the device application is permitted to access the device content via the shared device application in the shared space **216**. The restricted execution service **202** can then allow the device application access to the device content via the shared device application based on the request token while the restricted execution mode is activated. The restricted execution service can also deactivate the restricted execution mode **214** responsive to a PIN code or authentication credential entered on the device lock screen, and return to a normal user mode of the mobile device in which the device application **218** has unrestricted access to the device content **222**.

The restricted execution service **200** implements a mechanism to indicate in which restricted modes a device application can run (e.g., execute) based on a task information field of a device application task. The task information field indicates whether a specific task can be allowed to execute in a shared space when the restricted execution mode is activated. This new field will be a bit mask, which a navigation server will use to compare to the navigation filter mask that MobileUI will give to it when a restricted mode is entered. These are marked per task instead of by application because some first-party device applications have tasks that can be allowed to function in a child share space (e.g., Kid's Corner), but not all of the application functionality is allowed while a restricted execution mode is activated on a device. If a device application is allowed to run in a shared space, the restricted execution service can trace an API task call through the application layer from an originator (e.g., device application) that initiates the task call based on a token that is passed along to a core system component that would not otherwise be able to determine whether the task call was originated from a device application running in the shared space. The token can be utilized to determine if the task call is protected from a restricted execution mode.

Example methods **300**, **400**, and **500** are described with reference to respective FIGS. **3-5** in accordance with one or more embodiments of restricted execution modes. Gener-

ally, any of the services, components, modules, methods, and operations described herein can be implemented using software, firmware, hardware (e.g., fixed logic circuitry), manual processing, or any combination thereof. Example methods may be described in the general context of executable instructions stored on computer-readable storage media that is local and/or remote to a computer processing system, and implementations can include software applications, programs, functions, and the like.

FIG. **3** illustrates example method(s) **300** of restricted execution modes. The order in which the method is described is not intended to be construed as a limitation, and any number or combination of the method operations can be combined in any order to implement a method, or an alternate method.

At **302**, a device lock screen is displayed on an integrated display device of a mobile device. For example, the mobile device **100** (FIG. **1**) displays a device lock screen **104** on the integrated display device **102** of the mobile device. At **304**, the display is transitioned from the device lock screen to display a shared space user interface of a shared space without a PIN code or other authentication credential entered on the device lock screen. For example, an input system of the mobile device **100** receives an input, such as a gesture input or device selectable control input, and the input is effective to transition from displaying the device lock screen **104** to display the shared space user interface **110** of a shared space **216** without a PIN code or other authentication credential entered on the device lock screen.

At **306**, a restricted execution mode of the mobile device is activated. For example, the restricted execution service **202** at the mobile device **100** activates the restricted execution mode **214** of the mobile device in response to entering the shared space. At **308**, access of a device application to device content is restricted while the restricted execution mode is activated. For example, the restricted execution service **202** at the mobile device **100** restricts access of a device application **218** to the device content **222** while the restricted execution mode **214** is activated.

At **310**, the restricted execution mode is deactivated responsive to a PIN code or other authentication credential entered on the device lock screen. For example, the restricted execution service **202** at the mobile device **100** deactivates the restricted execution mode responsive to a PIN code or other authentication credential entered on the device lock screen. At **312**, the device returns to a user mode of the mobile device in which the device application has unrestricted access to the device content. For example, the restricted execution service **202** at the mobile device **100** returns to a user mode of the mobile device in which the device application **218** has unrestricted access to the device content **222**.

FIG. **4** illustrates example method(s) **400** of restricted execution mode. The order in which the method is described is not intended to be construed as a limitation, and any number or combination of the method operations can be combined in any order to implement a method, or an alternate method.

At **402**, a shared device application that is included in the shared space is allowed access to the device content while the restricted execution mode is activated. For example, the restricted execution service **202** (FIG. **2**) at the mobile device **100** allows access to the device content **222** to a shared device application **220** that is included in the shared space **216** while the restricted execution mode is activated.

At **404**, the device application that requests access to the device content via the shared device application is restricted

while the restricted execution mode is activated on the device. For example, restricted execution service **202** at the mobile device **100** restricts a device application **218** task call to the shared device application **220** with a request to access the device content **222** while the restricted execution mode is activated on the device.

At **406**, the device application is allowed access to the device content via the shared device application while the restricted execution mode is activated based on a request token that the device application includes in a task call to the shared device application for the device content. For example, restricted execution service **202** at the mobile device **100** allows access to the device content **222** by the device application **218** via the shared device application while the restricted execution mode is activated based on a request token that the device application includes in a task call to the shared device application for the device content. The request token indicates that the device application is permitted to access the device content via the shared device application in the shared space.

FIG. **5** illustrates example method(s) **500** of restricted execution modes. The order in which the method is described is not intended to be construed as a limitation, and any number or combination of the method operations can be combined in any order to implement a method, or an alternate method.

At **502**, access to the device content is restricted based on device application tasks being designated as restricted while the restricted execution mode is activated, where the device application initiates a task call to access the device content. For example, restricted execution service **202** (FIG. **2**) at the mobile device **100** restricts access to the device content **222** based on device application tasks being designated as restricted while the restricted execution mode **214** is activated, where a device application **218** initiates task calls to access the device content.

At **504**, the device application is restricted from a file system of the mobile device while the restricted execution mode is activated. For example, restricted execution service **202** at the mobile device **100** restricts a device application **218** from a file system of the mobile device while the restricted execution mode is activated.

At **506**, the device application is determined as user-designated to allow the device application access to the device content in a restricted execution mode if the device application is included in the shared space as a shared device application. Alternatively, at **508**, the device application is determined as designed as not to be allowed access to the device content even if the device application is included in the shared space. For example, restricted execution service **202** at the mobile device **100** can determine whether a device application user-designated to allow the device application access to the device content in a restricted execution mode if the device application is included in the shared space as a shared device application. The restricted execution service **202** may also determine that a device application is designed (e.g., programmed) as not to be allowed access to the device content even if the device application is included in the shared space. Additionally, this type of a programmed device application may also be implemented as not even being eligible for user-designation to be included in the shared space.

Although described herein as a single restricted execution mode, in some examples, a device provides multiple restricted execution modes, such as a first restricted execution mode associated with a child shared space for facilitating sharing a mobile device with a child and a second

restricted execution mode associated with a safe driving shared space for facilitating safer driving by a user of a mobile device. These various restricted execution modes may each impose a different set of limitations on the functionality of the device. For example, the child-related execution mode might block access to email data, changes to device settings, or in-app purchases, while the second driving safety restricted execution zone might block graphical user interfaces that could distract a driver from the road.

From the lock screen displayed on a device, without entering a PIN or other authentication credentials, a user may be able to reach different shared spaces, each of which has a different restricted execution mode associated with it. For example, from the lock screen, a user might enter a first gesture (e.g., a left swipe) to reach a first shared space having a first restricted execution mode and a second different gesture (e.g., a right swipe) to reach a second, different shared space having a second restricted execution mode. In some examples, a shared space associated with a restricted execution mode may be accessed from different entry points than receiving an input (e.g., a gesture input) on the lock screen.

The features and concepts described herein for restricted execution modes may be utilized to support and implement one or more restricted execution modes associated with a child shared space of a device for facilitating sharing the device with a child. This Restricted Execution Modes application incorporates a related U.S. patent application Ser. No. 13/726,095 filed Dec. 22, 2012 entitled "Mobile Device Child Share", the disclosure of which is incorporated by reference herein in its entirety. Mobile device child share enables implementation of a "Kid's Corner" (also referred to as a kid space or child zone) for parental control of any applications, data, functions, and features of a mobile device so that a parent can allow a child to play with the device without having access to the restricted applications, data, functions, and features. Kid's Corner is a child shared space that provides a custom destination on a mobile phone just for a child, and where the child goes to "play" on the device. In a child share space, child access is restricted with a restricted execution mode to only the applications, games, music, videos, movies and other content that a parent chooses. All of the settings and content outside of the Kid's Corner is protected and purchases can be blocked while in the Kid's Corner. The blocked and/or restricted applications and features of a mobile device may include the ability to make a phone call, send a text or access email, and access the Internet, such as to post to social networks or to search the Internet.

The features and concepts described herein for restricted execution modes may be utilized to support and implement one or more restricted execution modes associated with a safe driving shared space of a device for facilitating safe driving modes. This Restricted Execution Modes application incorporates a related U.S. patent application Ser. No. 13/726,097 filed Dec. 22, 2012 entitled "Mobile Device Safe Driving", the disclosure of which is incorporated by reference herein in its entirety. Mobile device safe driving enables implementation of one or more safe driving modes to minimize driver distractions of a mobile phone while driving a vehicle.

FIG. **6** illustrates an example system **600** in which embodiments of private interaction hubs and restricted access modes can be implemented. The system **600** includes an example mobile device **602**, which may be any one or combination of a wired or wireless device, such as a mobile phone, tablet, computing, communication, entertainment,



gaming, media playback, and/or other type of device. Any of the devices can be implemented with various components, such as a processing system and memory, as well as any number and combination of differing components as further described with reference to the example device shown in FIG. 10. As such, the mobile device 602 may implement techniques previously described in whole in or part, such as the techniques described with reference to the restricted execution service 202.

The mobile device 602 includes an integrated display device 604 on which user interfaces can be displayed, such as a hub user interface 606 of a hub application 608. The hub user interface offers a unified interactive view of the hub data 610 for a single, private interaction hub and the hub application 608 aggregates disparate types of the hub data 610 originating from the various member users of the private interaction hub. For example, the hub user interface may provide a single unified access point to shared hub messages, status updates, check-ins, hub calendar events, hub media, hub applications, and other types of hub content. As described above, a private interaction hub (or simply “hub”) is a private network or association of member users who voluntarily elect to privately interact and collaborate with each other in a bi-directional manner. The hub data 610 includes any shared data or metadata that is used to facilitate the interaction and collaboration between the members of a private interaction hub, and may include shared data for messaging, notes, contact management, documents, tasks, location updates, photos, calendar events, applications (to include collaborative gaming applications), and/or other media content, such as any type of audio, music, video, and/or image data that may be available or accessed from any source.

The basic functionality of an example private interaction hub is shown as a golf hub displayed in the hub user interface 606 of the hub application 608. For example, the hub user interface can include various selectable user interface tiles 612, such as a members tile that is selectable to initiate a display of the constituent members of the private interaction hub. The user interface tiles 612 may also include hub chat and/or messages tiles to allow a hub member to participate in shared messaging threads with the other member users of the hub. For example, as shown, the member “Bob” has asked “Anyone up for a round right now?” The user interface tiles 612 may also include a photo album tile that is selectable to view photos shared by any of the hub members with the hub, and a shared notebook tile from which the hub members can view shared notes. For example, the golf hub may include a shared notes document that compiles the hub members’ collective research of new golf equipment. The hub user interface 606 may also display a shared calendar that allows a member of the hub to view, edit, and post calendar events that will be shared with all of the other hub members. For example, the calendar tile shows an upcoming tee time at St. Andrews on Saturday at 9:00 a.m. for all of the members. When a user selects a group item (e.g., the message from Bob) or tile (e.g., the messaging tile), further details about the selected item or group items related to the selected tile may be displayed by the hub application itself or the hub application may call a different device application 636 (e.g., a messaging application) to display further details about the item(s).

When a user selects or otherwise engages with a piece of displayed hub data, such as the golf message from Bob, the hub application may provide additional details or options to the user to permit the user to interact further with the hub data. For example, the hub application may display controls

to allow the user to edit or reply to Bob’s message. Alternatively or in addition, when a user selects or otherwise engages with a piece of displayed hub data (e.g., Bob’s message), the hub application may launch or call another device application to permit the user to further interact with the piece of hub data (e.g., the hub application may call a native messaging application).

The hub user interface 606 of the hub application 608 can also include user-selectable access to third-party applications, such as when an application is “pinned” to, or otherwise shared with a private interaction hub. A pinned third-party application may also utilize the shared hub data, such as shared application preferences or shared application state data. For example, the golf hub shown displayed in the hub user interface 606 includes a live tile representing a third-party weather application that the members of the hub can quickly access to check the weather forecast at their local golf club, such as when planning an upcoming golf outing. A user of the mobile device 602 can also customize display aspects of a hub user interface, such as the content of the user interface and how the elements of the hub user interface are arranged. Another example of a hub user interface of the hub application 608 is a panoramic hub user interface, such as for a family-centric private interaction hub as shown and described in greater detail with reference to FIG. 9.

The example system 600 also includes a hub management service 614, and a cloud storage and service 616. The hub management service 614 manages the formation and maintenance of private interaction hubs 618. The hub management service can correlate or associate member users of a hub by associating account identifiers 620 of the members with one or more of the private interaction hubs. The account identifier 620 of a member user may be associated with an identifier of a private interaction hub 618 in a data table that the hub management service maintains to correlate the hub members with one or more of the private interaction hubs. The hub management service 614 may also associate devices that correspond to hub members based on device identifiers. The account identifiers 620 can include user membership identifiers and/or sign-on credentials, such as an email and password combination, or a username and password combination. The sign-on credentials may be single sign-on (“SSO”) credentials that are utilized for authentication purposes at a number of Web services, including the cloud storage and service 616.

The cloud storage and service 616 can include any type of cloud-based (e.g., network-based) data and messaging services 622. The messaging services may include any type of email, text (e.g., SMS, MMS), and/or instant messaging services. The data services may include any type of calendar, photo album, file or document sharing, location, mapping, music sharing, video sharing, gaming, contacts management, and/or notebook services, as well as any other type of services that can be used to share stored hub data 624. The stored hub data can include any form of messages, updates, events, content, media, and information that is maintained for the private interaction hubs 618, and is accessible from the mobile device 602, either upon a request from a device and/or upon a data “push” to the device. The cloud storage and service 616 also maintains stored hub metadata 626 that includes settings and information pertaining to the private interaction hubs 618, such as the name of a hub, the background image or photo of the hub, and an association of the hub members.

Although shown together as data and messaging services 622, various application data services and various messaging services may be operated on separate devices and/or

operated by separate, distinct entities. Additionally, although the hub management service **614** and the cloud storage and service **616** are shown as independent services, they may be implemented together as a single service. Further, a server device (or group of server devices) can include implemen-

5 tations of both the hub management service **614** and the cloud storage and service **616**, representative of a single entity that may be the same server system, company system, domain, and the like.

The cloud storage and service **616**, and its constituent data and messaging services **622**, interchange the stored hub data **624** and the stored hub metadata **626** between the mobile devices that are associated with member users of a private interaction hub **618**. For example, a data and/or messaging service of the cloud storage and service **616** can receive a copy of hub data **610** and/or hub metadata **628** from the mobile device **602** that is used by a hub member, store this hub data and hub metadata in the cloud storage as the respective stored hub data **624** and stored hub metadata **626**, and then distribute the stored hub data and stored hub metadata to other mobile devices associated with other member users of the same private interaction hub, as well as to other mobile devices associated with the same hub member. The stored hub metadata **626** can include membership information pertaining to the member users of a private interaction hub, hub identifiers that correlate a piece of hub data to a particular private interaction hub, user identifiers that correlate a piece of hub data to a particular member user, modification dates, and/or other metadata.

The cloud storage and service **616**, and its constituent data and messaging services **622**, may utilize single sign-on (“SSO”) credentials for authentication purposes to limit the dissemination of the stored hub data **624** and the stored hub metadata **626** to only the authorized devices of hub members. Additionally, any of the devices and services (e.g., implemented as server devices) described herein can communicate via a network **630**, which can be implemented to include a wired and/or a wireless network. The network can also be implemented using any type of network topology and/or communication protocol, and can be represented or otherwise implemented as a combination of two or more networks, to include IP-based networks and/or the Internet. The network may also include mobile operator networks that are managed by a mobile network operator and/or other network operators, such as a communication service provider, mobile phone provider, and/or Internet service provider.

The mobile device **602** includes an operating system **632** of the device, and the operating system includes a hub operating system service **634** that is implemented to integrate cloud-based services, a hub application **608**, and local device applications **636** with the operating system to implement aspects of the private interaction hubs **618**. The aspects that may be implemented include hub formation and membership maintenance, synchronizing the hub data **610** on the mobile device with the stored hub data **624**, as well as the hub metadata **628** with the stored hub metadata **626**, with the cloud storage and service **616**, and providing the hub application **608** and the local device applications **636** on the mobile device **602** with access to the hub data **610** and the hub metadata **628**. For example, the hub operating system service **634** may directly access the stored hub metadata **626** at the cloud storage and service **616**.

The hub operating system service **634** (or alternatively, the hub application **608**) may also determine and maintain a local copy of the membership associations of member users account identifiers **620** and identifiers of the private inter-

action hubs. The hub operating system service **634** may also synchronize the stored hub data **624** from the cloud storage and service **616** with the hub data **610** at the mobile device **602**, and synchronize the stored hub metadata **626** from the cloud storage and service with the hub metadata **628** at the mobile device. The hub operating system service **634** may also synchronize with the cloud storage and service **616** (e.g., by sending changes or additions to hub data **610** and hub metadata **628** to the cloud storage and service **616**). Such data synchronizations may occur in response to a user launching the hub application.

The mobile device **602** includes the device applications **636** that permit a user of the mobile device to access, create, and/or modify the hub data **610**, private data **638** of the user, as well as the stored hub data **624** that is managed by any of the data and messaging services **622** at the cloud storage and service **616**. Some or all of the device applications **636** may be implemented as client-side components or modules of any of the data and messaging services **622**, or may be implemented as standalone, native applications (e.g., local device applications) at the mobile device. The device applications **636** typically each consume and provide access to only a portion or subset of the hub data **610** and the private data **638**, such as only a single type of hub data and private data (e.g., only messaging data, but not calendar data). The device applications also typically present the consumed hub data to a user in conjunction with the private data **638**. Private data is data or metadata that is not associated with a private interaction hub and that has not been shared with other members of the hub (e.g., data that has not been shared via the cloud storage and service **616**).

The device applications **636** at the mobile device **602** may include a native or third-party messaging application that provides a user with messaging alerts and access to messaging threads. The messaging application provides access to both shared message threads shared with a private interaction hub and private message threads between a user of the mobile device and others who are not members of the hub. The messaging application also allows a user to send a message to all of the hub members without accessing a hub user interface of the hub application. The messaging application may not provide user access to other types of the hub data **610**, other than the hub messages. For example, the messaging application may not provide access to the shared calendar events or shared photo albums of the hub.

The device applications **636** may also include a native or third-party calendaring application that provides scheduling alerts and access to a visual calendar. The calendaring application provides user access to both shared calendar events that are shared with hub members, and private calendar events (e.g., Exchange calendar events) that have not been shared with other members of the hub. The calendaring application also allows a user to create and/or share a calendar event to all members of the hub without accessing a hub user interface of the hub application. The application may not provide user access to other types of the hub data **610**, other than the hub calendar events. For example, the calendaring application may not provide access to the shared message threads or shared photo albums of the hub.

The device applications **636** may also include a native or third-party media viewing and/or editing application that provides access to photo albums of digital photos or other digital media. The media application provides user access to both shared media files (e.g., photos, videos, and/or music) shared with a private interaction hub, and private media files that have not been shared with other members of the hub.

The media application also allows a user to share media files with all members of the hub without accessing a hub user interface of the hub application. The media application may not provide user access to other types of hub data **610**, other than hub media files. For example, the media application may not provide access to the shared message threads or shared calendar events of the hub.

The hub operating system service **634** can expose one or more Application Programming Interfaces (“APIs”), application binary interfaces, and/or other types of interfaces **640** to the hub application **608** and to the device applications **636** on the mobile device **602** to allow these applications to access, generate, and/or modify the hub data **610** and/or the hub metadata **628**, as described herein. The hub operating system service **634** can be implemented as an integrated software component or module of the operating system **632**. The hub operating system service can be maintained at the mobile device **602** as executable instructions that are stored on computer-readable storage media, such as any suitable memory device or electronic data storage as described with reference to the example device shown in FIG. **10**. Additionally, the hub operating system service can be executed with a processing system at the mobile device to implement aspects of private interaction hubs.

In embodiments, the hub operating system service **634** can initiate the hub management service **614** to provision a private interaction hub **618**. A user of the mobile device **602** can start a private interaction hub **618** and also invite others to join an existing private interaction hub. For example, the hub user interface **606** of the hub application **608** may provide an existing hub member with the option to add a new member to the hub, and the user may identify the prospective member by providing either a mobile device number, or by selecting an existing contact from one of their social networks or other contacts.

The hub operating system service **634** can receive the request from an existing member user of the device and, in response, the hub operating system service **634** and/or the hub management service **614** communicates an invitation to join the hub as an SMS, MMS, or instant message sent to the prospective member’s mobile device that may include a link to a registration site or other registration instructions. The hub operating system service **634** and/or the hub management service **614** receives (e.g., via a registration website) an acceptance to the invitation to join the private interaction hub that includes at least an account identifier (such as an SSO credential), and associates the new member with the existing hub at the hub management service **614**. Updated membership information, including the new member’s account identifier **620** may also be propagated to other mobile devices of other members in the private interaction hub from the hub management service **614**. When the new member user joins the hub, he or she may be prompted to download and/or install various applications configured to provide access to the stored hub data **624** and the stored hub metadata **626**, such as the hub application **608** and/or the any of the device applications **636**. The hub application **608** may also be the entry point by which a user creates a new hub and/or modifies the membership of an existing hub.

A private interaction hub **618** can be provisioned for any association of people, such as family members, coworkers, friends, neighbors, and any other people that may be associated together in a hub. Additionally, a member user of one private interaction hub may also be a member of multiple hubs, which can be based on a single member sign-on that identifies the member to the hub operating system service **634** and/or to the hub management service **614**. For

example, a person may be a member of a family hub that associates members of the person’s family, as well as a member of a neighborhood hub that associates members of the person’s neighborhood, and a golf hub that associates the person’s friends that often golf together.

The integration of the hub application **608** with the operating system **632** of the mobile device provides that a user of the device can view a message or update on the hub user interface **606** and in an application user interface of an application that is associated with the message or the update. For example, a hub calendar is integrated with the calendar application (e.g., a device application **636**) on the mobile device **602**, and a calendar update that is displayed in the hub user interface **606** can be selected by the user to initiate the update being displayed in a calendar user interface of the calendar application. Alternatively, the user may view the calendar user interface and select a calendar event that is associated with a private interaction hub to initiate a display of the hub calendar, which includes the calendar event for the members of the hub. As another example, a hub calendar event can be displayed in a hub user interface, and the device calendar application can access and display the hub calendar event along with any private data calendar events that only the user of the device has access to view in a user interface of the device calendar application. The hub application **608** and the device application **636** both acquire the same hub calendar event data (e.g., the same hub data **610** stored on the mobile device). The two different user interfaces (e.g., a hub user interface and a device application user interface) display the same calendar event data.

In another example, the hub messages and chat features are integrated with messaging applications (e.g., the device applications **636**) on the mobile device **602**, and an email, text, or instant message that is displayed in the hub user interface **606** can be selected by the user of the mobile device **602** to initiate the message being displayed in a messaging application user interface. Alternatively, the user may view a recent message from a member of a private interaction hub in a messaging application user interface, and select the message to initiate a display of the hub messages interface, such as to view the discussion thread associated with the recent message.

In embodiments, the hub operating system service **634** at the mobile device **602** can receive social network updates for the member users of a private interaction hub **618**, such as when two or more of the members of the hub are also “friends” on a public social network site, such as (e.g., FACEBOOK®, TWITTER®, or LINKEDIN®). The social network updates can be pulled from a social network site based on the established association of the account identifiers **620** of the hub members of a private interaction hub **618** at the hub management service **614**. The hub operating system service **634** can then aggregate the social network updates for a particular hub for display in the hub user interface **606** or on a homepage “live tile” associated with the hub. The hub operating system service **634** at the mobile device **602** can also be implemented to coordinate multi-user interactive updates to an event that is managed in a private interaction hub. For example, several members of a hub may participate in a multi-player interactive game, and each successive interactive update from a member of the hub is initiated by the member at a respective associated mobile device.

FIG. **7** illustrates an example system **700** in which various embodiments of private interaction hubs, restricted execution modes, and/or family coordination can be implemented. The example system includes a client device **702**, which

may be any one or combination of a mobile phone **704**, tablet device **706**, computing device **708**, communication, entertainment, gaming, navigation, and/or other type of portable electronic device. Any of the client devices **710** can be implemented with various components, such as a processor and/or memory system, as well as any number and combination of differing components as further described with reference to the example device shown in FIG. **10**.

The example system **700** includes a device association service **712** that associates or correlates the client devices **710** by device identifiers **714**, user identifiers **716**, and/or by any other type of identifiable association. Any of the devices and services can communicate via a network **718**, which can be implemented to include wired and/or wireless networks. The network can also be implemented using any type of network topology and/or communication protocol, and can be represented or otherwise implemented as a combination of two or more networks, to include IP-based networks and/or the Internet. The network may also include mobile operator networks that are managed by mobile operators, such as a communication service provider, cell-phone provider, and/or Internet service provider. A mobile operator can facilitate mobile data and/or voice communication for any type of a wireless device or mobile phone.

The client devices **710** can each be associated with a different user, and the users are defined members of a family **720**. The example client device **702** is representative of the various client devices **710** in the family. Any of the client devices in the family can include services, such as software applications (e.g., computer-executable instructions), that can be executed by a processor or processor system to implement the embodiments described herein. In this example, the client device **702** includes a family coordination architecture **722** that implements features of a family hub; a parental control service **724** that implements features of a parent dashboard; a family check-in service **726**; a device quiet service **728** that implements features of quiet time and quiet zone; a safe driving service **730**; and a device sharing service **732**. The client device services are further described with reference to FIG. **8**.

Additionally, any one or combination of the various client device services may be abstracted for implementation by a network service provider, such as the device association service **712**. For example, the client devices **710** that are associated in the family **720** can be interconnected through a central computing device or system (e.g., may be one of the client devices **710**), which may be local to the multiple devices or may be located remotely from the devices. In embodiments, the central computing device may be a cloud service of one or more server computers that are connected to the multiple devices via the network **718** or other communication link. The interconnection architecture enables functionality across multiple devices to provide a common and seamless experience to a user of the multiple devices. Each of the client devices may have different physical configurations and capabilities, and the central computing device implements a platform to enable delivery of an experience that is both tailored to a particular device and yet common to all of the devices.

FIG. **8** further illustrates the various client device services that are described with reference to FIG. **7**. The client device **702** includes the family coordination architecture **722**, the parental control service **724**, the family check-in service **726**, the device quiet service **728**, the safe driving service **730**, and the device sharing service **732**, which may be embodied as the restricted execution service **202** described with reference to FIGS. **1-6**. In embodiments, the family

coordination architecture **722** may generally be implemented as a service, as described herein. Generally, any of the described services may be implemented and/or described in the general context of software, firmware, hardware (e.g., fixed logic circuitry), manual processing, applications, routines, programs, objects, components, data structures, procedures, modules, functions, or any combination thereof. A software implementation represents program code that performs specified tasks when executed by a computer processor. In embodiments, any of the processing, computation, filtering, code execution, etc. can be implemented with distributed computing services and/or devices, such as on a client device, a server device, and/or network-based service.

In this example of the client device services, the family coordination architecture **722** includes a family hub manager **800** that implements, coordinates, and/or manages various family features, such as family calendar **802**, family chat **804**, family shared contacts **806**, family journal and memories **808**, tasks and chores **810**, family keys **812**, and family budget **814**. The parental control service **724** implements features such as a parent dashboard manager **816**, age appropriate content control **818**, and safe social networking **820**. The device quiet service **728** implements features such as quiet time **822** and quiet zone **824**. The various client device services and features are further described throughout the document.

Any of the client device services can include, be integrated with, or implement any of the other client device services and applications. For example, the family coordination architecture **722** can include any one or combination of the parental control service **724**, the family check-in service **726**, the device quiet service **728**, the safe driving service **730**, and the device sharing service **732**. In embodiments, the family coordination architecture may be implemented for the coordination of time, messaging, data, activities, and any other shared services. The shared services may be any of the client device services and/or any type of shared services that may be associated with a service and/or multi-system operator (MSO) devices. Further, the parental control service can be implemented to throttle, expand, manage, and/or reallocate data sharing of the client device services.

Any of the family features and/or applications of the family coordination architecture can be implemented as private, some private and some public, or private with optional user control to share information and data with public third-party services and applications. Similarly, any of the client device services and applications described herein may be private, public, sharable, user-controllable, and/or any combination thereof. In embodiments, the family coordination architecture and/or the family hub manager can be implemented as an overall managing architecture, a collective embodiment of, and/or integration of any of the client device services and/or applications that may be implemented for expandability and instantiated together as the family coordination and/or the family hub architecture. Further, any of the client device services can include, be integrated with, or implement any of the other client device services and applications, and collectively may be embodied as a family hub and/or coordination architecture or service.

The device sharing service **732** can embody the restricted execution service **202** described with reference to FIGS. **1-6**, such as to implement a phone share feature provides that a user can share his or her phone (e.g., a mobile device) with another person, yet limit the other person's access to features, functions, and information on the phone. For example, a user owner of a mobile phone can activate a restricted execution mode on the device and then share the phone with

a stranger. In the restricted execution mode, only outgoing phone calls will be allowed and the restricted execution mode enforces the task restrictions to restrict an incoming call, yet allow the outgoing call when the origin of the outgoing call is traced to the device phone application that has been included in the shared space.

In an implementation, a parent can share his or her phone with a child to play a game on the phone, but the child cannot answer phone calls, read emails, access texting, access any other data and phone settings, or initiate any type of a monetary transaction (e.g., to buy a phone app or music download). Similarly, a phone user can share his or her photos on her phone with a friend that asks to look through the photos, but the friend cannot access any other phone data or settings. A phone user may also share his or her phone with anyone needing to make a phone call, but without giving access to any other phone data or settings.

Phone share as a feature of a restricted execution mode can be pass-coded to only allow another person access to designated functionality of the phone based on user set restrictions. A phone share pass-code can be quickly initiated with a gesture, key input, or sequence of key inputs. Additionally, phone share profiles can be implemented for different types of individuals, such as Friend, Parent, Stranger, Kid, Child, etc. The phone share features can also be implemented for a family phone in the house that any family member may take with them, such as when kids go out with friends, or a parent runs an errand to the store, or given to a house guest to use during their stay.

The device sharing service **732** is also implemented to restrict incoming phone calls and message displays to limit the communication functions of the mobile device **1000**, yet can allow an outgoing phone call for shared use. The message displays may include email and text message displays, calendar events and alerts, instant messages, and any other messages that may be displayed for the user that owns the device (e.g., rather than the temporary, shared user). In a shared use mode of the mobile device, the device sharing service **732** can also restrict access to applications that allow a user to initiate a monetary transaction, such as via a browser, music, and/or gaming application via which a user can conduct a purchase transaction, download music, purchase and download an application, and any other type of monetary transaction. Although, there may be instances when a child may be allowed to access more money, such as to take a cab in an emergency. The device sharing service **732** can also be implemented to limit a younger child's ability to pair his or her phone with the car, or to send items to the printer in a home from a phone. As phones become NFC enabled and the phone can replace keys when providing secure access, device sharing service **732** can be implemented to limit the ability of a child to open some doors using a phone device.

FIG. **9** is an example of a system **900** showing two different examples of hub user-interfaces **902**, **904** for a family-orientated hub. The description, layout, orientation, features, and organization of the text, images, photos, graphics, links, data, information, and presentation features shown with reference to the hub user interfaces, as well as with reference to any other user interfaces described herein and/or shown in the figures, are merely examples that may be altered in any aspect for various embodiments and/or implementations of mobile device check-in.

The hub is a central space for membership-orientated coordination of communications, activities, information, and integration. Designated member relationships can be utilized to define how the data and information is managed,

and can be implemented to leverage the social contract, such as between members of a defined familial group in the illustrated example. In one or more implementations, the hub is implemented as a user interface (e.g., via a client device application) for integration and aggregation of the membership-orientated communications, activities, and information. A hub can be implemented as a private, shared space between defined members. The hub contains links to other members' profiles, and based on restriction settings, allows aggregation for visibility of some of other members' data and information within the hub. The hub shares a group calendar which can be viewed and edited, a common text message window, a posting board, a shared photo album, a check-in feature, and any other type of shared information.

Devices and/or device accounts can be associated within a set of devices or device accounts (e.g., a family phone account, user accounts, a connected set of devices, and so on), and all or a subset of the devices or accounts can communicate with other devices or accounts. The members of a hub can be defined by any number of different classes of people, such as Junior, Teen, Mom, Dad, (or Parent), Grandparent, Nanny, Life-Coach, and so on for the illustrated example of a family. Further, the members of a family can be defined to distinguish a live-in Nanny from a Babysitter, for example.

Additionally, membership of the hub as well as use of the hub by the members can be controlled by a select collection of users, such as one or two mobile phones by the associated users of the client devices. For example, one of the members in the hub can be the designated control person, such as Mom who runs the household, employer, and so on.

From a single configuration of the members, the hub can be provisioned, setup, and propagated out, e.g., automatically. The features and configuration of a hub may default to an automatic, easy setup, but any rule, feature, or configuration aspect can be readily modified by a user. Provisioning a hub may be based on billing, e.g., a family or corporate billing plan. However, if a phone device is changed to a different carrier, for example, the phone device can still receive texts related to the hub. Alternatively or in addition, provisioning a hub can be based on email addresses, phone numbers, user account identifiers, or any other identifier.

A retail person selling a new phone package, for instance, can easily identify the members each to their new phone devices and initiate the hub being instantiated. From a consumer perspective, it just works and members can walk out of the store all set up. All of the data and information can be shared with a single selection, and thus the members do not have to share each item (e.g., a grocery list, photos, calendar, etc.) individually and separately.

The hub user interface may act as a shared space that is customizable and provides for user-generated and shared content. Some information can be shared, while other information is not. For example, Mom's complete Christmas list is not viewable by the other family members, but Dad and Kids can add to the list (and only view their contribution). Hub setup may be performed "a la carte," meaning only the features that members want displayed on the hub wall can be selected. For example, Mom wants to see the shopping list, whereas Dad does not shop and so wants to avoid having the list displayed on his device, yet he could still access the shopping list to add items when desired.

The hub user interface integrates functions, calendar functionality, event and/or data summaries (i.e., on the "wall"), as well as content that is shared between the members of the hub (e.g., lists, documents, etc.). For example, the hub user interface may include a "family

check-in” or “check-in” option. The hub user interface may also include a chat section where location check-ins messaged are displayed along with other messages interchanged between the members of the hub. The hub “wall” is representative of an area via which members of the group may add to as desired, like a lunchroom bulletin board, family refrigerator, and so on. In implementations, the information can be aggregated in pillars or columns and shown on the hub wall as illustrated. The hub wall can also represent an interrelation between any of the information and data that appears on the wall and its placement in time. The hub settings provide that a user can control which functions are integrated and displayed within the hub, such as on the wall.

The hub information may also be context relevant to the members of the hub, and the calendar includes shared hub events. Calendar updates can be posted as notice events on the wall, and a user can look at the wall to see upcoming hub events, or the events that pertain to one or more other members of the hub. Messaging may also be performed that is private among the members of the hub. A member can instant text (or other communication) to all other members in the hub. Texting—such as for a work meeting—can divide each members’ display on their respective devices into individual screens for each member.

The hub may also be extensible, and may link to a hard drive on a home computer, or sync to just one of the other devices, the manager, or cloud control (e.g., from a network-based service). The hub may also be extensible to third parties that add a note on the hub wall, such as implemented with application program interfaces (APIs) for functions to post data to the hub. A third-party application, however, would not have access to the context of the hub wall, such as to obtain or display hub data. The private information and hub data could be encrypted and only decrypted by the phone devices that are associated with the hub.

Thus, the hub supported by a hub coordination architecture may be thought of as a central space for coordination of communications, activities, information, and integration of members of the hub. Hubs may be defined to support a variety of different membership, such as for family members, coworkers, friends, acquaintances, fan clubs, and so forth. Therefore, although examples are discussed that relate to a family in the following discussion it should be readily apparent that membership in the hub may be defined in a variety of other ways without departing from the spirit and scope thereof. Accordingly, the hub coordination architecture may be used to support a variety of different functionality. An example of this functionality is described herein as a hub restricted execution service, and further aspects of private interaction hubs are also described herein.

FIG. 10 illustrates an example system 1000 that includes an example device 1002, which can implement embodiments of restricted execution modes. The example device 1002 can be implemented as any of the devices, services, and/or servers described with reference to the previous FIGS. 1-9, such as any type of client or mobile device, mobile phone, tablet, computing, communication, entertainment, gaming, media playback, and/or other type of device. For example, the mobile device 100 shown in FIGS. 1-2 may be implemented as the example device 1002.

The device 1002 includes communication devices 1004 that enable wired and/or wireless communication of device data 1006, such as media content and the shared messages, updates, and events data at the device. The media content can include any type of audio, video, and/or image data. The

communication devices 1004 can also include transceivers for cellular phone communication and/or for network data communication.

The device 1002 also includes input/output (I/O) interfaces 1008, such as data network interfaces that provide connection and/or communication links between the device, data networks, and other devices. The I/O interfaces can be used to couple the device to any type of components, peripherals, and/or accessory devices. The I/O interfaces also include data input ports via which any type of data, media content, and/or inputs can be received, such as user inputs to the device, as well as any type of audio, video, and/or image data received from any content and/or data source.

The I/O interfaces 1008 also support natural user interface (NUI) inputs to the device 1002, such as any interface technology that enables a user to interact with a device in a “natural” manner, free from artificial constraints imposed by input devices such as mice, keyboards, remote controls, and the like. Examples of natural user interface inputs may rely on speech recognition, touch and stylus recognition, gesture recognition on-screen and motion gesture recognition proximate the device, head, eye, and environment recognition and tracking, augmented reality and virtual reality systems, and any other type of audible, vision, touch, gesture, and/or machine intelligence that may determine user input intentions.

The device 1002 includes a processing system 1010 that may be implemented at least partially in hardware, such as with any type of microprocessors, controllers, and the like that process executable instructions. The processing system can include components of an integrated circuit, programmable logic device, a logic device formed using one or more semiconductors, and other implementations in silicon and/or hardware, such as a processor and memory system implemented as a system-on-chip (SoC). Alternatively or in addition, the device can be implemented with any one or combination of software, hardware, firmware, or fixed logic circuitry that may be implemented with processing and control circuits. The device 1002 may further include any type of a system bus or other data and command transfer system that couples the various components within the device. A system bus can include any one or combination of different bus structures and architectures, as well as control and data lines.

The device 1002 also includes computer-readable storage media 1012, such as data storage devices that can be accessed by a computing device, and that provide persistent storage of data and executable instructions (e.g., software applications, programs, functions, and the like). Examples of computer-readable storage media include volatile memory and non-volatile memory, fixed and removable media devices, and any suitable memory device or electronic data storage that maintains data for computing device access. The computer-readable storage media can include various implementations of random access memory (RAM), read-only memory (ROM), flash memory, and other types of storage media in various memory device configurations.

Generally, computer-readable storage media is representative of media and/or devices that enable persistent and/or non-transitory storage of data in contrast to mere signal transmission, carrier waves, or signals per se. A computer-readable signal media may refer to a signal-bearing medium that transmits instructions, such as via a network. The signal media can embody computer-readable instructions as data in a modulated data signal, such as carrier waves or other transport mechanism.

The computer-readable storage media **1012** provides storage of the device data **1006** and various device applications **1014**, such as an operating system that is maintained as a software application with the computer-readable storage media and executed by the processing system **1010**. In this example, the device applications also include a device share service **1016** that implements embodiments of restricted execution modes, such as when the example device **1002** is implemented as the mobile device **100** shown in FIG. 1. An example of the device share service **1016** is the restricted execution service **202** that is integrated with the operating system **204** at the mobile device **100**, as described with reference to FIG. 1.

The device applications **1014** can also include any of the services and applications **1018** that implement embodiments of restricted execution modes. The example device **1002** also includes a family coordination architecture **1020**, which may be implemented in the general context of software, firmware, hardware (e.g., fixed logic circuitry), or any combination thereof to support embodiments of restricted execution modes and/or mobile devices family coordination. The device **1002** can also include a positioning system **1022**, such as a GPS transceiver, or similar positioning system components, that can be utilized to determine a global or navigational position of the device.

The device **1002** also includes an audio and/or video system **1024** that generates audio data for an audio device **1026** and/or generates display data for a display device **1028**. The audio device and/or the display device include any devices that process, display, and/or otherwise render audio, video, display, and/or image data. In implementations, the audio device and/or the display device are integrated components of the example device **1002**. Alternatively, the audio device and/or the display device are external, peripheral components to the example device.

In embodiments, at least part of the techniques described for restricted execution modes may be implemented in a distributed system, such as over a “cloud” **1030** in a platform **1032**. The cloud **1030** includes and/or is representative of the platform **1032** for services **1034** and/or resources **1036**. For example, the services **1034** may include the cloud storage and service **206**, and any of the data services **208** as described with reference to FIG. 1. Additionally, the resources **1036** may include the accessible data **210** as described with reference to FIG. 1.

The platform **1032** abstracts underlying functionality of hardware, such as server devices (e.g., included in the services **1034**) and/or software resources (e.g., included as the resources **1036**), and connects the example device **1002** with other devices, servers, etc. The resources **1036** may also include applications and/or data that can be utilized while computer processing is executed on servers that are remote from the example device **1002**. Additionally, the services **1034** and/or the resources **1036** may facilitate subscriber network services, such as over the Internet, a cellular network, or Wi-Fi network. The platform **1032** may also serve to abstract and scale resources to service a demand for the resources **1036** that are implemented via the platform, such as in an interconnected device embodiment with functionality distributed throughout the system **1000**. For example, the functionality may be implemented in part at the example device **1002** as well as via the platform **1032** that abstracts the functionality of the cloud **1030**.

Although embodiments of restricted execution modes have been described in language specific to features and/or methods, the appended claims are not necessarily limited to the specific features or methods described. Rather, the

specific features and methods are disclosed as example implementations of restricted execution modes.

The invention claimed is:

1. A method comprising:

causing display of a device lock screen on a display of a mobile device, the device lockscreen including an indicator that the mobile device is locked;

receiving gesture input in any direction relative to the device lock screen;

responsive to receiving the gesture input in any direction relative to the device lock screen, activating a restricted execution mode and transitioning from displaying the device lock screen to displaying an interface of the restricted execution mode without unlocking the mobile device, the restricted execution mode restricting access to device applications or device content of the mobile device by granting access to shared device applications or shared device content, the shared device applications or shared device content comprising a subset of multiple ones of the device applications or a plurality of device content of the mobile device;

receiving an authentication credential; and

deactivating the restricted execution mode, unlocking the mobile device, and transitioning to a normal user mode responsive to receiving the authentication credential.

2. The method of claim 1, wherein the authentication credential comprises a personal identification number (PIN) code.

3. The method of claim 1, wherein the authentication credential comprises a credential other than a personal identification number (PIN) code.

4. The method of claim 1, wherein the gesture input comprises a swipe gesture.

5. The method of claim 1, wherein the shared device applications or shared device content of the mobile device are selected for inclusion in the restricted execution mode by a user owner of the mobile device.

6. A mobile device, comprising:

a display device configured to display a device lock screen and transition to a restricted execution mode responsive to receiving an input in any direction relative to the device lock screen, and deactivate the restricted execution mode and transition to a normal user mode in response to receiving an authentication credential; and

a processing system configured to activate and deactivate the restricted execution mode of the mobile device, the restricted execution mode of the mobile device restricting access to functionalities of the mobile device by allowing access to multiple shared functionalities of the mobile device, the multiple shared functionalities comprising a subset of the functionalities of the mobile device.

7. The mobile device of claim 6, wherein the multiple shared functionalities of the mobile device are selected for inclusion in the restricted execution mode by a user owner of the mobile device.

8. The mobile device of claim 6, wherein the input comprises selection of a button displayed on the device lock screen.

9. The mobile device of claim 8, wherein the device lock screen includes an additional button, and wherein the display device is further configured to transition to an additional restricted execution mode responsive to receiving selection of the additional button.

10. The mobile device of claim 6, wherein the input comprises gesture input on the device lock screen.

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11. The mobile device of claim 6, wherein the restricted execution mode restricts access to device content on the mobile device.

12. The mobile device of claim 6, wherein the device lock screen includes an indicator that the mobile device is locked. 5

13. The mobile device of claim 6, wherein the input comprises input other than an authentication credential.

14. The mobile device of claim 6, wherein the authentication credential comprises a personal identification number (PIN) code. 10

15. The mobile device of claim 6, wherein the authentication credential comprises a credential other than a personal identification number (PIN) code.

16. The mobile device of claim 6, wherein the input in any direction relative to the device lock screen comprises a swipe gesture in any direction on the device lock screen. 15

17. A method comprising:

causing display of a device lock screen on a display of a mobile device, the device lock screen preventing access to full functionality of the mobile device;

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activating a restricted execution mode of the mobile device responsive to receiving input in any direction relative to the device lock screen, the restricted execution mode restricting access to applications installed on the mobile device by granting access to multiple shared applications, the multiple shared applications comprising a subset of the applications of the mobile device, the activating being performed without authenticating the input as being received from an owner of the mobile device; and

deactivating the restricted execution mode and activating a normal user mode responsive to receiving a password or a personal identification number (PIN).

18. The method of claim 17, wherein the input comprises selection of a button displayed on the device lock screen. 15

19. The method of claim 17, wherein the input comprises gesture input on the device lock screen.

20. The method of claim 17, wherein the input comprises input other than the password or a pin.

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